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## COMPARISON OF THE OF 5-METHYLCYTOSINE DERIVATES CHANGES IN THE DNA OF CHRONIC MYELOID LEUKEMIA CELL LINE AFTER EXPOSURE TO VARIOUS FORMS OF VITAMIN C

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### Abstract:

Oxidation of 5-mCyt occurs with the participation of TET proteins and leads to the formation of many products: 5-hydroxymethylcytosine, 5-formylcytosine, 5-carboxycytosine. Their presence in the genome can activate silenced genes and affect the ability of certain proteins to bind DNA. Vitamin C is one of the cofactors of TET proteins and can affect the activation of transcription of certain genes. In our research, we compare changes in the levels of epigenetic markers in HAP1 cells exposed to L-ascorbic acid, sodium ascorbate and sodium ascorbate encased in a liposome carrier. Each form of vitamin C has been added to cell culture to achieve 100 µM concentration of vitamin C in medium. Nucleotide content was measured using 2D-UPLC-MS method. Vitamin C supplementation resulted to increase of demethylated 5-mCyt derivatives, while no significant changes between the different forms of vitamin C were observed.

### Keywords:

*epigenetics, DNA methylation, TET protein, cancer, vitamin C*

### Introduction

The information encoded in the DNA of eukaryotic cells is not fully available for transcription factors. At each stage of the cell and tissue development and differentiation, a temporary activation and silencing of certain genes occurs. This allows, for example, specialization of cells to perform their function or response to changes in the external environment. The regulation of gene activation and silencing is strictly regulated by epigenetic mechanisms. There are many ways to change gene expression. The primary is location of the gene on the DNA strand and degree of chromatin

condensation. Genes in the central part of the nucleus where access to transcription proteins is difficult may be expressed less frequently than genes on the periphery of the cell nucleus. Similarly, the condensed structure of heterochromatin makes it difficult to bind transcription factors to a DNA compared with relaxed euchromatin form, which is more transcriptionally active [1-3].

Many factors affect the degree of condensation of chromatin and the ability to bind proteins. These are, for example, chemical modifications of histone proteins. Chemical modifications can also affect DNA nucleotides. The presence of modified nucleotides also affects the ability of proteins to bind DNA strand [2, 3].

There are many forms of modified nucleotides. The best known is the methylation of cytosine by DNA methyltransferases. These enzymes modify cytosine located mainly directly next to guanine, known as CpG dinucleotides. The product of this reaction is 5-methylcytosine (5-mCyt), which presence in the promoter can silence the gene transcription. 5-mCyt is recognized by proteins with methyl-binding domain that are capable of specific binding of methyl group, e.g. MeCP2 participating in chromatin condensation [1-3]. Removal of 5-mCyt from DNA occurs by oxidation of the methyl group by TET proteins and the formation of 5-mCyt derivatives: 5-hydroxymethylcytosine (5-hmCyt), 5-formylcytosine (5-fCyt) and 5-carboxycytosine (5-caCyt) [1-4]. These derivatives are subsequently excised of the DNA strand by BER repair pathway and replaced by unmodified cytosine. The presence of each of these derivatives not only allows the removal of 5-mCyt from the genome. Many proteins specifically recognize individual nucleotide modifications, so the presence of oxidized 5-mCyt forms also participate in the regulation of gene expression. There are also other modified nucleotides considered as epigenetic marks involved in regulation of gene expression. One of them is 5-hydroxymethyluracil (5-hmUra), which is formed in DNA by the oxidation of thymine by TET proteins. The presence of uracil in DNA also may be a intentional epigenetic modification. It is assumed that uracil may be formed in DNA as a result of cytosine deamination - spontaneous or enzymatic, involving deoxycytidylate deaminase [5]. Uracil removal may occur by DNA repair pathways or with uracil glycosylase. There are also many other modifications of nucleotides, which was formerly associated with DNA damage, e.g. 8-oxoguanine (8-oxoGua) and N6-methyladenine. It is now believed that their presence may be part of epigenetic mechanisms underlying cell-specific gene expression [1, 2, 6].

## **The presence of modified nucleotide in tumors**

Changes in genome methylation profile occur at different stages of the organism development, but can also be associated with the pathological processes. Many cancer cells have disorders of the methylation and demethylation pathways of DNA. Hypomethylation, associated with the transcription activation, often affects protooncogenes and transposons. Increased 5-mCyt content is often found in suppressor genes and genes that encode DNA repair proteins [1, 3, 4].

In epigenome studies of cancer cells, decreased level of 5-hmCyt is often observed in, e.g. colon cancer, stomach cancer and breast cancer. This mainly applies to specific locations: promoters, gene bodies and intergenic regions [4, 7, 8]. Many studies have linked the low content of 5-hmCyt in some cancers to a worse prognosis for the patients. Elevated levels of 5-fCyt and 8-oxoGua have been shown in inflammatory bowel disease, while elevated levels of 5-hmUra in colorectal cancer [7].

Pathological changes in the concentration and localization of 5-mCyt and their demethylation products in DNA are often associated with the impairment of genome stability. One of possible factors of aforementioned state is a lack or limited TET proteins activity, which are considered to be tumor suppression proteins, arising from decreased expression of *TET* genes or their mutations. Mutations in the *TET2* gene are very common in haematological tumor cells and often result in increased proliferation of cancer cells and a greater tendency to malignant transformation. On the other hand, mutations of the *TET* genes in solid tumors are probably less frequent. The activity of TET proteins is also affected by the presence of small-molecule inhibitors, such as 2-hydroxyglutarate, which is an oncometabolite produced by abnormal isocitrate dehydrogenase (IDH) proteins as a result of mutations in their genes, that are frequent in hematological malignancies [9].

### **Effects of vitamin C on the cancer cells**

Vitamin C (L-ascorbic acid) is a cofactor of dioxygenases superfamily (including TET proteins involved in DNA demethylation), that are also dependent on the presence of iron ions and 2-ketoglutarate. As a potent antioxidant, it may restore pool of available iron ions and/or bind to specific sites of an enzyme, therefore, its crucial factor for maintaining TET proteins activity and subsequently the proper epigenetic modifications makeup [3, 4, 10].

As mentioned, impaired TET protein function can be observed in many cancer cells. One of the reasons is vitamin C deficiency, often observed in the blood of oncological patients. Additionally, vitamin C is an antioxidant that protects DNA from damage by radical oxygen species. Vitamin C also influences the processes of the immune response to inflammation. It also takes part in the synthesis of collagen. It is believed that this process may limit the metastasis of cancer cells, but at the same time limits the access of immune cells to tumor [4, 12].

Physiological concentrations of vitamin C in blood plasma are about 100  $\mu\text{M}$  [10, 13]. This is equivalent to a daily oral supplementation of approximately 100 mg of ascorbic acid. Higher levels of vitamin C in the blood are not achievable with oral intake due to its renal threshold (approximately 100  $\mu\text{M}$ ) and subsequent removal of excess vitamin C with the urine. Intravenous supplementation is also possible and it enables to achieve concentrations of plasma vitamin C that are many times higher than the physiological levels. Due to the possible prooxidative effect of vitamin C in high concentrations, the use of such supplementation is still controversial [12].

Some researchers believe that low levels of vitamin C in the blood correlate with an increased risk of developing cancer [9]. Vitamin C supplementation has been shown to reduce the risk of certain cardiovascular diseases development. However, clinical studies do not clearly confirm the beneficial effects of vitamin C supplementation by oncology patients. It is assumed that vitamin C has no therapeutic activity in the treatment of cancer, therefore its supplementation can only be an addition to conventional therapeutic strategies [12, 13].

### **Various forms of vitamin C**

We distinguish two enantiomers of ascorbic acid (L and D), both having similar antioxidant properties, but L-ascorbic acid is, due to its conformation, capable to bind to specific sites of enzymes or be recognized by various proteins and therefore has broader biological function. Physiologically in



the blood plasma, vitamin C occurs in the form of ascorbate anion or dehydroascorbic acid [10, 13]. Commercial preparations are also available and provide greater stability form of vitamin C. These are e.g. hydrophilic salts of sodium or magnesium ascorbate. Vitamin C may also be available in lipophilic forms, e.g. ascorbyl palmitate which, after passing through the cell membrane, can be converted to ascorbic acid. Another strategy to deliver vitamin C to cells is to encapsulate vitamin C in liposome carriers which are taken up by the cell endocytosis, in contrast to the physiological internalization of ascorbic acid and dehydroascorbic acid by their specific transporters [14, 15].

## Study of the effects of vitamin C on epigenetic modifications levels

The aim of the experiment was to observe the effect of different forms of vitamin C in physiological concentrations on the levels of selected modified nucleotides. In our research, we focused on the determination of levels of modified derivatives in the HAP1 cell line (comes from cells of a patient with chronic myeloid leukemia). Cells were exposed to 100  $\mu$ M concentrations of vitamin C in the forms of L-ascorbic acid, sodium L-ascorbate and sodium L-ascorbate in a liposomal carrier. The cells were isolated in 3 repetitions for the control and test group at each of time points, every 3h to 48h (ascorbic acid exposure) or to 72h (sodium ascorbate exposure). Cells were collected to isolate DNA from them, which was hydrolysed into single nucleosides. Their level was studied by chromatographic method using 2D tandem ultra performance liquid chromatography with mass spectrometer.

The results of our experiment indicate no significant changes in the level of 5-mCyt after exposure of each form of vitamin C. On the other hand, we observed a clear increase in the levels of oxidized derivatives of 5-mCyt and the levels of 5-hmUra. Their highest levels occur within 18-24h after exposure to vitamin C regardless of the form of compound used. The levels of nucleosides modifications were comparable after each of using forms of vitamin C.

The increased levels of 5-hmCyt, 5-fCyt, 5-caCyt and 5-hmUra after exposure to vitamin C indicates, that each of the forms used is capable to stimulating the activity of TET proteins with the same intensity. The highest levels of derivatives occur within 18-24 hours from the addition of vitamin C to the cellular medium. This is in line with our previous studies of vitamin C levels in cells. We showed that after 12-24 hours of HAP1 cell exposure, there was the highest concentration of vitamin C in a single cell.

## Summary

Our study was not intended to demonstrate the cytotoxic properties of vitamin C on cancer cells but to evaluate the effect of vitamin C on nucleosides levels arising from using various forms of ascorbic acid. In our studies, we did not observed significant differences between the effects of different forms of vitamin C on the TET protein activity. However, incubation with 100  $\mu$ M of each tested form of vitamin C significantly increased the levels of 5-mCyt epigenetic derivatives in the HAP1 cells. The effect of 24h of vitamin C supplementation on levels of modified nucleosides was comparable to previously published scientific studies [16, 17]. Due to the effect of epigenetic mechanisms on the regulation of gene expression, we suggest supplementation *in vitro* cell cultures



with vitamin C at physiological concentration. As our research shows, supplementation with ascorbic acid, sodium ascorbate or liposome carrier has a similar effect on TET proteins in the HAP1 line.

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## Literature

- [1] Z. Qifan, S. Reinhard, A. Ramiro, *A Lexicon of DNA Modifications: Their Roles in Embryo Development and the Germline*. Front Cell Dev Biol, (2018), Vol. 6.
- [2] S. P. Sacharowski, T. J. Sarnowski, *Mechanizmy kontrolujące strukturę chromatyny*. Postepy Biochem, (2019), Vol. 65, 9-20.
- [3] J. M. Schvartzman, C. B. Thompson, L. W. S. Finley, *Metabolic regulation of chromatin modifications and gene expression*. J Cell Biol, (2018), Vol. 217, 2247-2259.
- [4] P. Ciesielski, P. Jóźwiak, A. Krześlak, *Białka TET a modyfikacje epigenetyczne w nowotworach*. Postepy Hig Med Dosw, (2015), Vol. 69, 1371-1383.
- [5] D. S. Bryan, M. Ransom, B. Adane, K. York, J. R. Hesselberth, *High resolution mapping of modified DNA nucleobases using excision repair enzymes*. Genome Res., (2014), Vol. 24, 1534-1542.
- [6] A. M. Fleming, C. J. Burrows, *8-Oxo-7,8-dihydroguanine, friend and foe: Epigenetic-like regulator versus initiator of mutagenesis*. DNA Repair, (2017), Vol. 56, 75-83.
- [7] M. Starczak, E. Zarakowska, M. Modrzejewska, T. Dziaman, A. Szpila, K. Linowiecka, J. Guz, J. Szpotan, M. Gawronski, A. Labejszo, A. Liebert, Z. Banaszkiwicz, M. Klopocka, M. Foksinski, D. Gackowski, R. Olinski, *In vivo evidence of ascorbate involvement in the generation of epigenetic DNA modifications in leukocytes from patients with colorectal carcinoma, benign adenoma and inflammatory bowel disease*. J Transl Med, (2018), Vol. 16.
- [8] W. Kuo-Chiang, K. Chi-Hsiang, T. Chung-Yu, C. Nan-Hua, T. Ya-Ting, L. Guan-Cheng, L. Hing-Chung, L. Shiuh-Inn, C. Po-Min, L. Yan-Hwai, T. Kuo-Wang, *Ten-eleven translocation 1 dysfunction reduces 5-hydroxymethylcytosine expression levels in gastric cancer cells*. Oncol Lett, (2018), Vol. 15, 278-284.
- [9] J. Jeschke, E. Collignon, F. Fuks, *Portraits of TET-mediated DNA hydroxymethylation in cancer*. Curr Opin Genet Dev, (2016), Vol. 36, 16-26.
- [10] J. Guz, R. Oliński, *Rola witaminy C w regulacji epigenetycznej*. Postepy Hig Med Dosw, (2017), Vol. 71, 747-760.
- [11] A. Zhitkovich, *Nuclear and Cytoplasmic Functions of Vitamin C*. Chem Res Toxicol, (2020), Vol. 33, 2515-2526.
- [12] E. Pawłowska, J. Szczepańska, J. Blasiak, *Pro- and Antioxidant Effects of Vitamin C in Cancer in correspondence to Its Dietary and Pharmacological Concentrations*. Oxid Med Cell Longev, (2019).
- [13] J. Kaźmierczak-Barańska, K. Boguszewska, A. Adamus-Grabicka, B. T. Karwowski, *Two Faces of Vitamin C—Antioxidative and Pro-Oxidative Agent*. Nutrients, (2020), Vol. 12.

- [14] K. Błaszczak-Świątkiewicz, P. Olszewska, E. Mikiciuk-Olasik, *Zastosowanie nanocząsteczek w leczeniu i diagnostyce nowotworów*. J Oncol, (2013), Vol. 63, 320-330.
- [15] M. Szwed, M. L. Torgersen, R. V. Kumari, S. K. Yadava, S. Pust, T. G. Iversen, T. Skotland, J. Giri, K. Sandvig, *Biological response and cytotoxicity induced by lipid nanocapsules*. J Nanobiotechnology, (2020), Vol. 18.
- [16] D. W. Sant, S. Mustafi, C. B. Gustafson, J. Chen, J. M. Slingerland, G. Wang, *Vitamin C promotes apoptosis in breast cancer cells by increasing TRAIL expression*. Sci Rep, (2018), Vol. 8.
- [17] E. A. Minor, B. L. Court, J. I. Young, G. Wang, *Ascorbate Induces Ten-Eleven Translocation (Tet) Methylcytosine Dioxygenase-mediated Generation of 5-Hydroxymethylcytosine*, J Biol Chem, (2013), Vol. 288, 13669-13674.

## RELATIONSHIP BETWEEN SEDENTARY BEHAVIOUR AND SPINAL COLUMN PAIN IN ADOLESCENTS AGED 16-19 YEARS

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### **Abstract:**

The aim of the study was to assess the prevalence of pain in various spinal segments in relation to the screen time (ST), sedentary behaviour (SB) during the day. A group of 518 subjects aged 16-19 years were examined. A questionnaire was used to collect information on SB and pain. The chi-square, Student's t-test, Spearman's rank correlation were used to assess the link between variables. A higher level of the time spent in front of the TV screen and total SB was observed in girls ( $p < 0.001$ ). Boys spent significantly more time on the computer and the Internet. Girls more often than boys felt pain in each spine section ( $p < 0.001$ ). In girls, a significant association was observed between cervical spine pain and time spent watching TV ( $p = 0.035$ ). Studies confirmed the link between SB and pain in the cervical spine. There is a need to introduce preventive activities based on physical activity, especially in the group of girls in order to prevent future problems and minimise the negative effects of a sedentary lifestyle.

### **Keywords:**

*adolescents, pain, sedentary behaviour*

### **Introduction**

Sedentary behaviour is the most popular form of activity in families and educational institutions. The wide availability of this form makes young people use it more often and more willingly, displacing behaviours associated with moderate and intensive physical activity. According to WHO recommendations, adolescents should limit sedentary behaviour to a minimum, especially that associated with computer use or television viewing. However, there is no set limit of time that is considered safe [1]. In some countries it is recommended that adolescents and children should not sit in front of a computer/TV screen for more than 2 hours a day outside of school [2, 3].

This is due to the fact that sedentary behaviour of more than 2 hours a day (14 hours/week) quite often causes many metabolic diseases, including overweight and obesity [4]. In addition, sitting time has been found to be negatively associated with some cancers, cardiovascular diseases, chronic obstructive pulmonary disease (COPD), diabetes and is also a cause of high mortality related to these

diseases [5]. It has also been shown that a number of the health ailments signalled above begin in childhood, hence concern for the health of the younger generation has become a public health priority. According to reports, the time spent on sedentary behaviour by school children and adolescents is steadily increasing. The American Psychological Association reports that adolescents between 13 and 18 years of age, apart from school and homework responsibilities, devote an average of 7.22 hours/day [5] to television and computer-related activities, and more than 60% of all adolescents devoted more than 2 hours/day to such activities, while reporting only 32 minutes/day of moderate to vigorous physical activity per day [6]. A similar trend is observed in European countries: over 81.2% of girls and 76.7% of boys aged 15-17 declare sedentary behaviour of at least 4.30 hours a day [7]. Some studies report gender differences in the use of electronic devices [7-9]. Girls are much more likely than boys to spend more time on sedentary behaviour. In addition, girls seem to surf the Internet and send text messages longer than boys, while boys prefer TV and computer games [7].

Spinal pain is a serious medical, ergonomic and social problem that affects a large proportion of the adult population in almost every country in the world. Statistics have shown that back pain, especially lumbosacral and cervical spine, accounts for a significant proportion of care expenditure worldwide [10-11]. Due to the characteristics of pain (severity, duration, location, type of pain) it can temporarily or permanently impede daily functioning, impair performance, and may also become a cause of absenteeism from work or school. Moreover, it is the only cause of long-term disability [12].

Spinal pain syndromes show variability over time. While young and slightly older children are less likely to report back pain problems, the incidence increases in the later years of life [13].

Prolonged sitting in front of a computer/television screen is one of the risk factors for pain. However, the mechanism of the effect of sitting behaviour on pain has not been well recognised. Some studies have suggested increased intra-discal pressure, prolonged static posture associated with inadequate muscle tone, reduced muscle strength, bad posture, or slowed metabolic processes leading to excessive body weight as the main reason for the impact of sitting on pain [14-17].

The adolescent period seems to be particularly susceptible to the occurrence of back pain. A significant prevalence of school-related behaviours, homework, computer and television use as part of school duties and leisure time can exacerbate pain in different spinal segments. In order to prevent possible future degenerative changes and to provide prophylactic help at the stage of diagnosing spinal pain, it seems important to make a broad diagnosis of the problem, which, apart from the frequency of pain, will assess the lifestyle, including sedentary behaviour.

## **The aim of the study**

The aim of the study was to assess the prevalence of pain in various spinal segments in relation to time spent on TV, computer, Internet and other electronic media, as well as sedentary behaviour during the day in general. In addition, the influence of gender on objective health assessment as well as as possible significant associations between sedentary behaviour and pain were evaluated.

It is likely that prolonged sitting in front of a screen of various electronic media, as well as general time associated with inactive behaviour during the day increases the frequency of pain. Furthermore, gender substantially influences health and fitness self-assessment as well as the association of sedentary behaviour with pain complaints.

## **Material and methods**

The research programme was carried out in 2018 between February and April. It was a cross-sectional study and covered 518 students of secondary schools in the Świętokrzyskie province, including 222 girls (42.86%) and 296 boys, students of grades 1-4. The material for the study was randomly selected. During the procedure of selecting schools and students for the study, the number of schools in the voivodship was verified, taking into account the place in which it is located (city, small town) and the type of school. Next, the selected institutions were asked for permission to conduct the survey, and parents of minors were asked for permission to survey their children. This is the second wave of research related to relationship between sedentary behaviour and spinal column pain in adolescents aged 16-19 years.

The conducted research was a survey study, so the basic tool was a questionnaire of the author's own design. The questionnaire included questions about the gender of the subject (female - male), place of residence divided into three categories (city - small town - village). A city was defined as a place with more than 100 thousand inhabitants. Moreover, the questionnaire included questions about the subjective opinion on the financial situation, health and fitness. A 5-grade scale was used: 1-very good, 2-good, 3-neither good nor bad, 4-poor, 5-very bad. The respondents had the opportunity to determine the pain in the cervical, thoracic and lumbar spine. In the assessment of pain frequency, a 5-grade response scale was also applied with the following distinguished categories: 1-never, 2-occasionally, 3- sometimes, 4-often and 5 very often.

To assess sitting time, questions were asked about the time spent on television, computer, Internet and other electronic media, other sedentary behaviours, and the number of days per week the subjects spent time on them. The procedure for counting time in hours per day provided for the quotient of the product of days and time and the number of days per week.

Measurements of body height and weight were taken by the researcher. BMI was calculated according to the formula body mass (kg)/body height (m<sup>2</sup>).

For categorised (qualitative) characteristics, frequencies and percentages were counted. A non-parametric chi-square test was used to determine the relationship between them and the gender of the subjects.

For continuous (quantitative) parameters, distributions were checked using the Shapiro-Wilk test. Then, basic statistical measures were calculated: mean and standard deviation in the study gender groups. To assess the significance of intergroup differences, Student's t-test or Mann-Whitney test was used depending on the distribution and homogeneity of variance.

Determination of the relationship between time spent on sedentary behaviour and the frequency of pain syndromes was possible using non-parametric Spearman(rho) correlations. The analysis was performed in the gender groups of the subjects.

The significance level was defined as  $p \leq 0.05$ . Statistica 13.3 package was used for the calculations (STATSOFT.PL).

## Basic definitions

Sedentary behaviour – activity during which energy expenditure is less than or equal to 1.5 METs, when a person adopts a sitting or lying position. This activity does not include time spent sleeping [18, 19]. Also included in this category of inactive behaviour is time spent on TV, the Internet, computers and other electronic media, during which a person can surf the Internet, communicate with others and play games.

## Results

Basic data related to the characteristics of the group are presented in Tab. 1. Respondents most often declared the village as their place of residence. Girls more often than boys lived in small towns, while boys more often than girls lived in cities of more than 100,000 inhabitants. The percentage of boys attending technical and vocational schools was higher than that of girls. Significantly more girls than boys attended general education schools. An important correlation was observed between the subjective assessment of the material situation and the gender of the respondents. Boys more frequently than girls rated their situation as very good (24.91% vs. 14.41%). In girls, average assessments prevailed (25.42% vs. 16.01%).

Tab. 1. Environmental characteristics of the study group

Variables		Boys		Girls		p
		N	%	N	%	
Place of living	Urban area	65	23.13	23	9.71	<0.001
	Small town	49	17.44	64	27.00	
	Rural area	166	59.07	150	63.29	
School	High school	58	20.64	122	51.48	<0.001
	Technical college	184	65.48	107	45.15	
	vocational school/vocational secondary school	39	13.88	8	3.38	
Family economic situation – self assessment	Very good	70	24.91	34	14.41	0.012
	Good	155	55.16	134	56.78	
	Neither good nor bad	45	16.01	60	25.42	
	Bad	8	2.85	4	1.69	
	Very bad	-	-	1	0.42	
Health – self assessment	Very good	119	42.35	57	24.05	<0.001
	Good	133	47.33	142	59.92	<0.001
	Neither good nor bad	17	6.05	29	12.24	
	Bad	4	1.42	8	3.38	
	Very bad	8	2.85	1	0.42	
Physical condition – self-assessment	Very good	102	36.30	40	16.88	<0.001
	Good	128	45.55	136	57.38	
	Neither good nor bad	46	16.37	53	22.36	
	Bad	5	1.78	8	3.38	
Organized PA <sup>1</sup>	Yes	64	22.94	36	15.32	0.030
	No	215	77.06	199	84.68	
Recreational PA <sup>1</sup>	Yes	200	71.17	138	58.23	0.002
	No	81	28.83	99	41.77	

<sup>1</sup>PA - physical activity;  
source: own calculations



Considerably more boys than girls declared very good health (36.30% vs. 16.88%) and fitness (36.30% vs. 16.88%). Girls tended to rate both of these spheres lower, hence significantly more often than boys they perceived themselves as healthy at a good (59.92% vs. 47.33%) or average (12.24% vs. 6.05%) level, and with good (57.38% vs. 45.55%) and average (22.36% vs. 16.37%) fitness. They also appeared to be less involved in sports activities (15.32% vs. 22.94%), and recreational activities (58.23% vs. 71.17%) than their male peers.

The mean age of the subjects was  $17.25 \pm 6.58$  and was similar in boys and girls. The levels of height, weight and BMI were significantly different according to the gender of the subjects. Boys were found to be taller, heavier and more bulky compared to their female peers (Tab. 2). When analysing data related to sedentary behaviour of adolescents, it was observed that girls, as opposed to boys, spent significantly more time watching TV ( $p=0.004$ ), and sitting time in general ( $p=0.003$ ). Boys compared to girls spent significantly more time on computer, internet, mobile phone ( $p=0.035$ ).

Tab. 2. Characteristics of sedentary behaviour among the subjects

Variables	Boys	Girls	p
	$\bar{x}(sd)$	$\bar{x}(sd)$	
Body height (cm)	178.59(6.48)	166.12(6.76)	<b>&lt;0.001</b>
Body mass (kg)	71.16(11.60)	56.66(9.18)	<b>&lt;0.001</b>
BMI ( $kg/m^2$ )	22.11(3.61)	20.24(3.58)	<b>&lt;0.001</b>
Screen time – TV (hrs/day)	2.23(1.87)	2.61(1.72)	0.004
Screen time – computer, mobile phone, tablet (hrs/day)	3.57(1.80)	3.23(1.79)	0.035
Total screen time (computer, TV, mobile phone, tablet) – (hrs/day)	5.68(2.72)	5.76(2.63)	0.743
Sitting time during a day (hrs/day)	5.75(3.13)	6.27(2.83)	0.003

Source: own calculations

Tab. 3 presents the frequency of pain in relation to the gender of the subjects. The most frequently reported ailment was pain in the lower back, the least frequent was thoracic pain. Boys more often than girls used the category never when describing pain. Girls used the following categories to describe the frequency of pain: occasionally, sometimes, often or very often. All observed relationships between pain and gender appeared to be significant.

Tab. 3. Spinal pain among adolescents

Spinal column pain		Boys		Girls		p
		N	%	N	%	
cervical spine	At all	173	62.45	99	41.95	<0.001
	Occasionally	66	23.83	63	26.69	
	Sometimes	28	10.11	23	9.75	
	Often	8	2.89	23	9.75	
	Very often	2	0.72	6	2.54	
thoracic spine	At all	210	75.54	152	64.68	0.043
	Occasionally	41	14.75	42	17.87	
	Sometimes	19	6.83	24	10.21	
	Often	6	2.16	11	4.68	
	Very often	2	0.72	6	2.55	
lumbar spine	At all	174	63.97	107	45.15	0.001
	Occasionally	46	16.91	55	23.21	
	Sometimes	34	12.50	43	18.14	
	Often	13	4.78	24	10.13	
	Very often	5	1.84	8	3.38	

Source: own calculations

Tab. 4. Correlation between frequency of spinal pain and time spent on sedentary behaviour

Feeling pain		The sum of sedentary behaviors related to exposure to the TV screen, tablet, computer, cell phone	Time spent on other electronic media and the Internet	Time spent on watching television	Sedentary behavior during the day
Pain in the cervical spine	Girls	0.10	-0.02	<b>0.16</b> ( <b>p&lt;0.05</b> )	0.06
	Boys	0.10	-0.04	0.01	0.02
Pain in the thoracic spine	Girls	0.04	-0.05	0.10	0.12
	Boys	-0.02	-0.06	0.03	0.03
Pain in the lumbar spine	Girls	-0.04	-0.05	0.10	0.12
	Boys	-0.02	-0.08	0.08	0.06

Source: own calculations

Slight and weak correlations were observed between time spent on sedentary behaviours and the frequency of pain occurring in different spinal segments (Tab. 4). Most of them were positive, especially with respect to time spent on TV, sedentary behaviours during the day, and in three cases the sum of behaviours related to exposure to TV, tablet and computer screens. The direction of these correlations is suggested by the fact that the longer time adolescents spent on different forms of sedentary behaviour, the more frequent their pain symptoms were. When analysing the relationship between time spent on computer games and the Internet, an inverse relationship was observed. The more time adolescents spent on such activities, the less frequently they experienced pain. However, as noted earlier, these were non-significant relationships. The only significant correlation was observed in the group of girls between pain in the cervical spine and time spent on television (rsp=0.16; p<0.05). This was a positive relationship (Tab. 4, Fig.1).

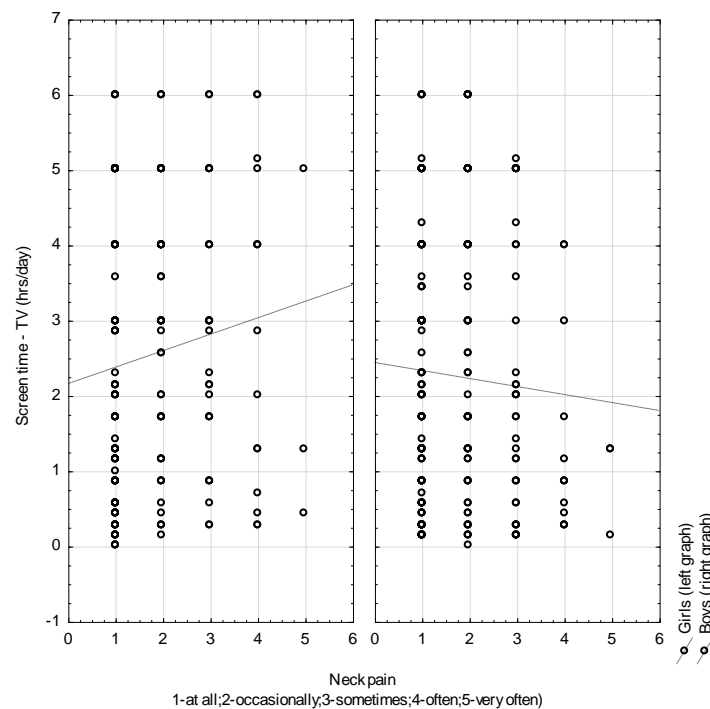


Fig. 1. Daytime sedentary behaviour and frequency of thoracic spine pain  
Source: own calculations

## Discussion

The study showed gender differences in the assessment of health, frequency of pain in different spinal segments, fitness of the subjects and their involvement in sports and recreational physical activity. Boys, in contrast to girls, more often described themselves as more healthy and less often reported pain. They were also more involved in sports training and additional physical activity undertaken during the day.

Previous studies did not show a consistent direction as to which gender rated its health status higher and was more vulnerable to pain. Although the prevailing notion that women feel less healthy and are more sensitive to pain than men is supported by some reports. For example, a study of a population of the elderly over 60 found lower levels of self-assessment in women. This was due not only to the significantly higher number of medical conditions and more frequent pain, but also to fear and worry about further potential illnesses they might develop. In men, on the other hand, the lower level of self-evaluation was rather due to the current threat of a specific disease [20]. In a slightly younger population, the research results seem to confirm the direction signalled earlier [21]. According to Beceviciene et al. [22], female gender during adolescence and young adulthood was one important factor that increased the likelihood of lower self-assessed physical activity and fitness in adolescents with psychosomatic complaints in adolescents aged 11-19 years - (OR:1.92; PU 1.57-2.35). In the study by Bleidorn et al. [23] the contrary results were presented and Regitz-Zagrosek noted that self-assessed health and self-perception did not depend on the gender of the respondents [24]. It is worth mentioning that the perception of one's health depends on many factors. The influence of hormones, psychological gender differences in self-perception, established gender role stereotypes

in different environments and even the role of genetics cannot be excluded [24]. In addition, the role of age and other processes were highlighted: including biological maturation and the formation of the cognitive ability to see oneself in a more realistic light [23, 24].

Both sexes reported spinal pain, but girls, in contrast to boys, declared its occurrence significantly more often. Boys, on the other hand, reported pain in the category: never. Interestingly, the majority of respondents reported pain in the lumbar spine (category: sometimes, often and very often: girls 31.61% vs. boys - 19.12%), cervical spine (category: sometimes, often and very often: girls 22.24% vs. boys - 13.79%) and thoracic spine (category: sometimes, often and very often: girls -17.44% vs. boys - 9.71%). Population-based studies of adults confirm the fact that lower back pain is the most commonly reported complaint, occurring more often in women than in men [25]. Grimmer et al. (2000), in a study of 1269 adolescents, found that girls significantly more often than boys reported lower back pain associated with prolonged sitting, the load of a school backpack and the time spent carrying it [26]. Gender differences in the perception and frequency of lower back pain were also observed in children and adolescents involved in additional sports activities. Interestingly, their frequency in girls was considerably higher than in boys in the older age group (12-15 years) [27]. Similar results were signalled by Straker et al. [28]. The mean monthly and lifetime frequency of pain in the cervical spine was approximately 10% - 12% higher in the girl group than in boys. There may be various reasons for the differences in the severity and frequency of pain in adolescents. Above all, according to Straker et al (2008), the rapid growth process in girls, which takes place 2 years earlier than in boys, seems to be of great importance. It is possible that the accompanying weakening of the muscular corset and weaker bone structure play a significant role in the pain experienced by adolescents. It also seems probable that girls and boys have different sitting positions or that other factors such as stress or physical activity may be involved [29].

Studies on the assessment of fitness and physical activity suggested substantially higher levels among boys and men than among girls and women in almost every age group [30-32]. Different interests and the division of social roles, which are formed from an early age, as well as the specificity of active forms of spending free time are responsible for this state of affairs. Boys are relatively more likely than girls to engage in prolonged forms of sport and recreational activity that are based on aerobic, intensive and moderate processes using large muscle groups. In addition, the movement potential of boys is significantly higher and more varied than that of girls at every level of development [33, 34]. In contrast, girls tend to engage in forms of physical activity that do not require too much physical exertion. It should also be noted that few girls and women take up sport [35]. The greater involvement of boys than girls in physical activities is also evidenced by the findings of Manios et al. (1999), who found that girls were more likely to engage in sports and recreational activities related to school, but unlike boys, they did not undertake movement activities related to physical work at home or outdoors [36]. Additionally, Seabra et al. (2008) drew attention to a significant decrease in physical activity and an increase in sedentary behaviour in girls over 16. According to the authors, this process is related to the achievement of biological maturity, the rate of growth and changes in body structure with a greater predominance of adipose tissue that occur during puberty [37]. It is likely that these facts may be of great importance in the higher self-assessment of physical fitness among boys and the lower among girls.

The study found significant differences in sedentary lifestyle activities. Girls compared to boys spent significantly more time watching TV programmes and on sedentary behaviour other than TV and computer, excluding school duties and sleep. In contrast, boys spent substantially more time on the computer, the Internet and other mobile electronic devices. The findings are in line with previous observations by Atkin et al. (2008). Girls were more likely than boys to spend time in front of a TV screen, while boys - on a computer. However, the observed relationships were only valid for weekdays excluding weekends [38]. A research on 13-year-old girls and boys in Poland documented differences in TV viewing and computer use as well as different types of health behaviour in gender groups, girls were more likely to prevail in groups with low physical activity and high time spent on TV [39]. Other studies showed partial agreement with the results I obtained [40]. Girls aged 14-19 used television and computer more often than boys ( $p < 0.001$ ). However, the results of a study of Australian children and adolescents aged 11-15 found the opposite direction [41].

The small but significant association observed in this study between cervical pain and time spent in front of a television screen in girls partially confirmed previous reports. Kędra et al (2015), examining adolescents aged 10-19 years showed a strong association of back pain with spending more than 6 hours per day on the computer. However, this was true for all distinguished age and gender groups [42]. Hakala et al. studying 12-13 and 15-16 year-old children noted that using a computer for more than 14 hours/week was associated with an increase in musculoskeletal pain in all anatomical segments of the spine [14]. A study of 45555 pre-adolescent children found that the length of time spent in front of a screen is associated with the severity of perceived back pain. 6 or more hours per day of screen time was linked to significantly increased relative risk factors for severe pain in girls and boys, with risk factors higher in girls than in boys. In addition, physically inactive individuals were also more likely to experience severe back pain compared to moderately active ones [43]. Similar research results were reported by Rodriguez et al (2016). Of 961 boys and girls aged 14-19 years, up to 61% reported musculoskeletal pain and almost 47% had low back pain. The average reported time spent using computers for purposes other than games was 1720 minutes per week, while time spent playing computer games was only 583 minutes per week. Both of these results were significantly associated with increased cervical and lumbar spine pain more often in females than males [44].

## **Conclusions**

The analysis showed a strong association of the assessment of health, physical condition and pain symptoms with the gender of the respondents. Differences in sitting time were also associated with gender. Girls spent longer time in front of the TV, while boys- on the computer. The observed relationship between sitting time and neck pain in girls indicates the need to organise preventive activities based on physical activity. This will make it possible to minimise the negative health effects of prolonged sitting in front of a TV screen or other electronic devices which enable the acquisition of knowledge and maintaining contact with others.

## Literature

- [1] WHO WHO guidelines on physical activity and sedentary behaviour, <https://www.who.int/publications/i/item/9789240015128>, 25. 11. 2020.
- [2] Australian Government Department of Health, Physical activity and exercise guidelines for all Australians, 2021, <https://www.health.gov.au/health-topics/physical-activity-and-exercise/physical-activity-and-exercise-guidelines-for-all-australians#>, 7. 05. 2021
- [3] American Psychological Association. What do we really know about kids and screens? 2020. <http://www.apa.org/monitor/2020/04/cover-kids-screens>, 1.04. 2020.
- [4] E. Suliga, E. Cieřła, D. Rębak, D. Kozieł, S. Głuszek, , Med Sci Monit., (2018), Vol. 24, 7633-7645.
- [5] American Psychological Association. What do we really know about kids and screens? 2020. <http://www.apa.org/monitor/2020/04/cover-kids-screens>, 1.04. 2020.
- [6] V. Carson, S. Hunter, N. Kuzik, C.E. Gray, V.J. Poitras, J.P. Chaput, T.J. Saunders, P.T. Katzmarzyk, A.D. Okely, S. Connor Gorber, M.E. Kho, M. Sampson, H. Lee, M.S. Tremblay. Appl Physiol Nutr Metab., (2016), Vol.6, Suppl 3, :S240-265.
- [7] J. López-Fernández, A. López-Valenciano, G. Mayo, X. Liguori, M.A. Lamb, R.J. Copeland, A. Jiménez, ,BMC Public Health., (2021), Vol. 21, 784.
- [8] G.L. de Moraes Ferrari, C. Pires, D. Solé, V. Matsudo, P.T. Katzmarzyk, M. Fisberg, J. Pediatr., (2019), Vol. 95(1), 94–105.
- [9] A.R. Cooper, A. Goodman, A.S. Page, L.B. Sherar, D.W. Esliger, E.M. van Sluijs, L.B. Andersen, S. Anderssen, G. Cardon, R. Davey, K. Froberg, P. Hallal, K.F. Janz, K. Kordas, S. Kreimler, R.R. Pate, J.J. Puder, J.J. Reilly, J. Salmon, L.B. Sardinha, A. Timperio, U. Ekelund, ,Int J Behav Nutr Phys Act., (2015), Vol. 12, 113.
- [10] E. Rysiak, P. Drągowski, I. Prokop, P. Jakubów. ,Now Lekarskie., (2013), Vol. 82(5), 399–405.
- [11] J. Hong, C. Reed, D. Novick, M. Happich, ,Spine., (2013), Vol. 38(1), 75-82.
- [12] D. Hoy, L. March, P. Brooks, F. Blyth, A. Woolf, C. Bain, G. Williams, E. Smith, T. Vos, J. Barendregt, C. Murray, R. Burstein, R. Buchbinder, ,Ann Rheum Dis., (2014), Vol. 73,6; 968-974.
- [13] S.G. Muthuri, D. Kuh, R. Cooper, ,Pain., (2018), vol. 159(4), 764-774.
- [14] P.T. Hakala, L.A. Saarni, R.L. Punamäki, M.A. Wallenius, C.H. Nygård, A.H. Rimpelä. ,BMC Musculoskelet Disord., (2012), Vol. 13, 41.
- [15] A.L. Nachemson. ,Spine., (1981), Vol. 6(1), 93-97.
- [16] T.A. Beach, R.J. Parkinson, J.P. Stothart, J.P. Callaghan, ,Spine J., (2005), Vol. 5(2), 145-154.
- [17] R. Kordi, M. Rostami, , Iran J Pediatr., (2011), vol. 21(3), 259-270.
- [18] MedlinePlus, Screen time and children, 2019, <https://medlineplus.gov/ency/patientinstructions/000355.htm>, 17.05.2019.
- [19] M.S. Tremblay, S. Aubert, J.D. Barnes, T.J. Saunders, V. Carson, A.E. Latimer-Cheung, S.F.M. Chastin, T.M. Altenburg, M.J.M. Chinapaw, ,Int J Behav Nutr Phys Act., (2017), Vol. 14(1), 75.



- [20] Y. Benyamini, E.A. Leventhal, H. Leventhal, *Psychosom Med.*, (2000), Vol. 62(3), 354-364.
- [21] J.K. Bora, N. Saikia, *PloS One.*, (2015), Vol.10(11), e0141953.
- [22] M. Baceviciene, R. Jankauskiene, A. Emeljanovas. , *BMC Public Health.*, (2019), vol. 19(1); 980.
- [23] W. Bleidorn, R.C. Arslan, J.J. Denissen, P.J. Rentfrow, J.E. Gebauer, J. Potter, S.D. Gosling, *J Pers Soc Psychol.*, (2016), Vol. 111(3), 396-410.
- [24] V. Regitz-Zagrosek, *EMBO Rep.*, (2012), Vol. 13(7), 596-603.
- [25] I. Alnaami, N.J. Awadalla, M. Alkhairy, S. Alburidy, A. Alqarni, A. Algarni, R. Alshehri, B. Amrah, M. Alasmari, A.A. Mahfouz, *BMC Musculoskelet Disord.*, (2019), Vol. 20(1), 56.
- [26] K. Grimmer, M. Williams, *Appl Ergon.*, (2000), Vol. 31(4), 343-60.
- [27] R. Kikuchi, T. Hirano, K. Watanabe, A. Sano, T. Sato, T. Ito, N. Endo, N. Tanabe, *BMC Musculoskelet Disord.*, (2019), Vol. 20(1), 327.
- [28] L.M. Straker, P.B. O'Sullivan, A.J. Smith, M.C. Perry, J. Coleman ,*Aust J Physiother.*, (2008), Vol. 54(2), 127-133.
- [29] T. Duggleby, S. Kumar, *Disabil Rehabil.*, (1997), Vol. 19(12), 505-512.
- [30] M.R. Azevedo, C.L. Araújo, F.F. Reichert, F.V. Siqueira, M.C. da Silva, P.C. Hallal, *Int J Public Health.*, (2007), Vol. 52(1), 8-15.
- [31] L. Rubín, A. Suchomel, R. Cuberek, L. Dušková, M. Tláskalová, *J Hum. Sport & Exerc.*, (2017), Vol. 12, 219-235.
- [32] J. Planinšec, S. Fošnarič, *Percept. Mot. Skills.*, (2005), Vol. 100(2), 349–353.
- [33] R.J. Boraita, E.G. Ibort, J.M.D. Torres, D.A. Alsina, *Child Ind Res.*, (2020), Vol. 13, 1937–1951.
- [34] T. Abe, C.F. Kearns, T. Fukunaga, *Br J Sports Med.*, (2003), Vol. 37(5), 436-40.
- [35] R.O. Deaner, S.M. Balish, M.P. Lombardo. ,*Evol Beh Sci.*, (2016), Vol. 10(2), 73–97.
- [36] Y. Manios, A. Kafatos, C. Codrington, *J Sports Med Phys Fitness.*, (1999), Vol. 39(1), 24-30.
- [37] A.F. Teixeira e Seabra, J.A. Maia, D.M. Mendonça, M. Thomis, C.J. Caspersen, J.E. Fulton, *Med Sci Sports Exerc.*, (2008), vol. 40(1), 65-70.
- [38] A.J. Atkin, T. Gorely, S.J. Biddle, S.J. Marshall, N. Cameron, *Pediatr Exerc Sci.*, (2008), Vol. 20(4), 446-56.
- [39] M. Jodkowska, A. Oblacińska, I. Tabak, K. Mikiel-Kostyra, *Przegl Epidemiol.*, (2011), Vol. 65(3), 497-502.
- [40] A. Allafi, A.R. Al-Haifi, M.A. Al-Fayez, B.I. Al-Athari, F.A. Al-Ajmi, H.M. Al-Hazaa, A.O. Musaiger, F. Ahmed, , *Public Health Nutr.*, (2014), vol.17(9), 2045-52.
- [41] L.L. Hardy, T. Dobbins, M.L. Booth, E. Denney-Wilson, A.D. Okely. , *Aust N Z J Public Health.*, (2006), Vol.30(6), 534-540.
- [42] A. Kędra, D. Czaprowski. ,*Probl Hig Epidemiol*, (2015), Vol. 96(1), 143-148.
- [43] A.C. Joergensen, K. Strandberg-Larsen, P.K. Andersen, L. Hestbaek, A.N. Andersen, *BMC Musculoskelet Disord.*, (2021), Vol. 22(1), 393.
- [44] G. Rodrigues Reis Silva, A. Carolina Rodarti Pitangui, M. Katherine Andrade Xavier, M. Aurélio Valois Correia-Júnior, R. Cappato De Araújo, *J Pediatr (Rio J.)*, (2016), Vol. 92(2), 188-196.

## **SUPREME AUDIT OFFICE – SPECIFICS OF A CONSTITUTIONAL BODY**

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### **Abstract:**

Financial control bodies are key to ensure the legal compliance of individuals in any institution where public finances are handled. In Poland, such a body is the Supreme Audit Office headed by an apolitical President elected for a six-year term. The purpose of this article is to present the specificity of the operations and organization of the Supreme Audit Office by pointing out the guidelines set by the legislator in the Constitution of the Republic of Poland of 2 April 1997, the Act on the Supreme Audit Office of 23 December 1997 and the Order of the President of the Supreme Audit Office on the detailed internal organization and jurisdiction of organizational units of the Supreme Audit Office of 29 August 2011 and selected thematic sources. The article uses methods of the research of documents based on collecting, selecting and describing the interpreted reality.

### **Keywords:**

*Supreme Audit Office, structure, finance*

### **Introduction**

The Supreme Audit Office in the Republic of Poland is alongside the Ombudsman and the National Broadcasting Council, the main constitutional organ of state control. The legal doctrine has accepted the statement that the Office guards the state penny as the body of financial control. The position of the Supreme Audit Office among state bodies has been determined as the supreme body of state control, which indicates its special importance in state structures. In its activities, the Office, is independent and acts through its representatives in an organised manner based on collegiality. In its activities, the Supreme Audit Office is subject exclusively to the Sejm, and its supreme nature is manifested in a number of regularities, of which only the most important ones will be mentioned: "Firstly, the Supreme Audit Office decides independently and finally (sometimes after an internal appeal procedure), without the possibility of its decisions being overruled or changed by another body, even the Sejm, to which the Supreme Audit Office is subject. Secondly, the inspections of the Supreme Audit Office are intended to serve the proper functioning of the entire system of state bodies, and not only the audited entity or one or more bodies" [1]. The Supreme Audit Office, in carrying out the tasks stipulated by the legislator, cultivates the values of public interest,

independence, professionalism and credibility. The most important mission of the Supreme Audit Office is independent, professional control of public tasks in the interest of citizens and the state. In order to illustrate the specificity of this constitutional body, the legal acts directly determining the Supreme Audit Office and selected thematic sources have been analysed.

## **History of the Supreme Audit Office**

The Supreme Audit Office, as a comprehensive body in the structure of Polish constitutional authorities, is part of the internal control system for the execution of the state budget. The beginning of the formation and systematisation of the institution of state control is considered to be the transition movements from monarchical to parliamentary regimes of all kinds. The Polish state budget control body, now established as the Supreme Audit Office, represents the summing up of more than six centuries of achievements of state bodies. In the period of the First Republic of Poland the Treasury Tribunal was established as the controlling body of the common treasury, then in its place, in the 18th century, treasury commissions were set up [the Treasury Commission of the Crown and the Treasury Commission of the Grand Duchy of Lithuania]. In the Duchy of Warsaw, by a decree of King Frederick August, the Main Chamber of Accounts was established on 14 December 1808, as the controlling and auditing body for the state, local government and public coffers, to a limited extent. After changes resulting from the Congress of Vienna and the creation of the Kingdom of Poland, Tsar Alexander I set up the Audit Chamber of the Kingdom of Poland, with tasks almost identical to those of the Audit Chamber of the Duchy of Warsaw. The only additional power was to interfere with the draft budget of the Kingdom of Poland. The regaining of independence by Poland opened a new stage in the creation of a state system. On 7 February 1919, the Head of State Józef Piłsudski signed a decree establishing the Supreme Audit Office of State- an independent body, subordinate only to the Head of State, with permanent control responsibilities, which enabled comprehensive control of public finances. In the Second Republic, on the basis of the March Constitution of 1921, the Supreme Audit Office was established as a body for financial control of the entire state administration. The Office acted as a collegiate body consisting of independent judges, an independent body acting jointly with a parliament. "In Poland during the interwar period, the supreme specialised control body, the Supreme Audit Office, in accordance with Article 9 of the Constitution of 17 March 1921, and later Article 77 of the Constitution of 23 April 1935, operated on the basis of collegiality, independence from government and autonomy. Poland thus found itself at that time in a group of countries which chambers of control or audit were organised on the basis of these three principles. This was the status of, for example, the Cour des Comptes in France and Belgium, the Corte dei Conti in Italy, and the chambers of audit in Austria and Czechoslovakia" [2]. The period of the Polish People's Republic was the moment of the decline of the administrative independence of the Supreme Audit Office. It was manifested by the establishment, in the place of the Supreme Audit Office, of a new control body - the Ministry of State Control, which was part of the administrative-governmental structure and was responsible no longer only to the Parliament, but also to the administration and the government. It was not until 1976 that it was decided to modify the Supreme Audit Office and to establish it as a part of the division of state bodies. The measures taken in 1976, as well as in the four subsequent years, led to the adoption of a new Act on the Supreme Audit Office in 1980, thanks to

which the Supreme Audit Office was once again isolated from the pressures of the model of administrative and governmental dependence [3]. The collapse of communism and the establishment of the Third Republic of Poland made it possible for the Sejm to adopt on 23 December 1994 the Act on the Supreme Audit Office, which is currently in force, and to adopt the Constitution of the Republic of Poland on 2 April 1997, which lays down the foundations of the entity that is today the Supreme Audit Office.

### **Duties of the Supreme Audit Office according to the Constitution of the Republic of Poland of 1997**

The Constitution of the Republic of Poland of 2 April 1997 indicates that the duties of the Supreme Audit Office are linked to the legislative body, that is the Sejm, and are manifested mainly through the obligation to provide certain materials on a regular basis. The Constitution indicates that the duties of the Supreme Audit Office include submitting to the Sejm an analysis of the execution of the state budget and assumptions of monetary policy, an opinion on the discharge of the Council of Ministers, this is constituting an advisory body to the Sejm with respect to expressing an opinion enabling the Sejm to approve the report on the execution of the budget act. "From the political point of view, this is the fundamental task of the Office, as it summarises the implementation of the budget by the government and provides the Sejm with expertly prepared material for its decision on the discharge" [4]. Further duties of the Office include the submission of information on the results of inspections, the submission of motions and speeches and the presentation of an annual report on its activities to the Sejm [5]. "The Constitutional Tribunal stated in 1998 that subordination to the Sejm cannot give rise to a violation of the essence of the Independence of the Supreme Audit Office. From this it follows that subordination has constitutional limits. The literature emphasises that "audit findings, assessments, comments and conclusions formulated by the Supreme Audit Office can only be verified in proceedings conducted by the Chamber and are not subject to change even by the Sejm" [6].

### **Functions of the Supreme Audit Office according to the Constitution of the Republic of Poland from 1997**

Article 203 of the Constitution indicates that the functions of the Supreme Audit Office include the control function, which manifests itself by controlling the activities of government administration bodies, the National Bank of Poland, state legal persons and other state organisational units from the point of view of legality, economy, expediency and reliability. Further competencies of the Supreme Audit Office include the possibility to audit the activities of local government authorities, municipal legal persons and other municipal organisational units from the point of view of legality, economy and reliability. The last scope of competence of the Chamber includes the possibility to control from the point of view of legality and economy the activities of other organisational units and economic entities to the extent to which they use state or municipal property or funds and fulfil their financial obligations to the state [5]. "In addition, it controls the execution of the budget, financial and property management of the Chancellery of the President of the Republic of Poland, the Chancellery of the

Sejm, the Chancellery of the Senate, the Constitutional Tribunal, the Ombudsman, the National Broadcasting Council, the General Inspector of Personal Data Protection, the Institute of National Remembrance - Commission for the Prosecution of Crimes against the Polish Nation, the National Electoral Office, the Supreme Court, the Supreme Administrative Court and the National Labour Inspectorate (Article 4(1))" [7]. The Supreme Audit Office is entitled to audit the courts only in budgetary terms. "There are no provisions that would grant the Supreme Audit Office the right to access judges' asset declarations, nor a provision that would oblige a judge to make his or her asset declaration available to authorities other than those explicitly listed in the Act - Law on the System of Common Courts" [8]. The limited control of the Supreme Audit Office over the courts results from the basic principles of the Constitution of the Republic of Poland, in particular from the principles of the division and balance of powers, the distinctiveness and independence of courts, the independence of judges and the rule of law.

## **Control of the Supreme Audit Office**

The control of the Supreme Audit Office includes checking the activities, of co-administration with the subordinate body as well as their coordination. Controls are carried out by the Office at the request of the Sejm or its bodies, at the request of the President of the Republic of Poland, the President of the Council of Ministers and on its own initiative. The audit process is simplified into three general stages. The first stage is the determination of the actual state of affairs, that is the state of implementation indicating what the actual situation is. The second stage is the determination of the binding state, that is the state of determination indicating how things should be according to the adopted and binding law. The third stage is the comparison of the state of designation with the state of execution, that is the comparison of what the actual situation is and how the given obligation should be executed according to the law.

The Supreme Audit Office undertakes audit activities from the perspective of legality, economy, reliability and purposefulness. Legality is the verification of audited activity in terms of its compliance with the provisions of the law in force, both general and internal, e.g. specifying the tasks and competences of employees. Therefore, the basic task of the supreme state control body must always be to assess whether the law is observed, to determine the reasons for its possible non-observance and to present conclusions aimed at eliminating this state of affairs. Thus, the purpose of Supreme Audit Office activities is not only to ascertain possible violations, but also to indicate their reasons, which often results in *de lege ferenda* motions addressed to the Sejm" [9]. Economy manifests itself in the form of a "system of control" [9]. Economy is manifested by slogan postulates such as maximisation of the effect, minimisation of the outlay while maintaining high quality standards. It is an analysis aimed at indicating whether the money was used economically and efficiently, and the outlays were proportional to the effects achieved. If damages are found, the controllers check whether all possibilities were used to prevent them or limit their size. "According to J. Nagórny, this criterion should be understood in two ways: as the application of economic and financial rules in order to achieve specific goals and as a moral attitude in which "care and concern for the material goods entrusted to a given institution are an expression of responsibility not only for a specific good, but also for the whole state" [9]. Reliability consists in checking the compliance of



the activities of the inspected entity with the requirements of knowledge, technique and with the principles of good faith. Inspectors examine whether the inspected entities performed their duties with due diligence, conscientiously and in a timely manner. The measure of integrity assesses the behaviour of employees of public institutions. The ethos of employees is not formally defined by law, nevertheless it is a very important element of the functioning of any public body, both state and local government. Purposefulness "this criterion may be dealt with when the Chamber, in the notice of suspicion of a criminal offence, makes an allegation of committing an offence under Article 231 of the Criminal Code, this is exceeding powers or failing to perform a duty by a public official" [9]. This criterion is an assessment of whether the activities conducted by the audited entity fell within the objectives set for it by the provisions of law. It is also important whether the optimum methods and means were used to achieve the set objectives and, above all, whether the set objectives were achieved. Two types of purposefulness are mentioned:

- a) Objective - checking the activities leading to the objective,
- b) Methodological - checking the appropriateness of the choice of the way to achieve the objective.

The Supreme Audit Office conducts audit proceedings within the limits of strictly defined principles. In particular, the "principle of objectivity, which implies impartial performance of tasks by the Supreme Audit Office and its employees supervising or carrying out audit activities, as well as reliable documentation of audit results, the principle of legality by undertaking activities exclusively on the basis of the Act on the Supreme Audit Office, in accordance with the regulations defining their essence are indicated" [10] and "the principle of material truth in the light of which the auditor determines the factual state on the basis of evidence collected in the course of proceedings, strives to make findings consistent with the actual factual state" [10]. Within the organisation, the course of proceedings is conducted based on the principles of: "the adversarial principle - in the control proceedings the interested parties are enabled to actively participate, to submit explanations, to make reasoned objections to the control findings, the principle of writtenness - which assumes such consolidation of the control activity and the principle of efficiency - which assumes due and timely performance of activities so that the control objective is achieved as quickly as possible and without unnecessary workload" [10]. "The result of an audit is that the Supreme Audit Office hands over to the manager of the audited entity (and if necessary also to the manager of the superior entity as well as to the competent state or local government bodies) the post-control statement which includes the assessment of the audited activity, resulting from the findings described in the audit protocol, and if irregularities are found - also comments and conclusions on their removal" [7].

## **Structure and Organs of the Supreme Audit Office**

The system of the Supreme Audit Office is characterised by mutual cooperation and subordination of control bodies to the main member of the Chamber. The organisation of the Supreme Audit Office has been shaped as a "radial type of cooperation, this is one in which ties are concentrated in the Chamber as the central point of the system. The Chamber plays a leading role here, being obliged to influence the participants in the system and at the same time to be influenced by them. At the same time, the interaction of the individual participants in the system takes place



through the Supreme Audit Office. It can be said that such a system functions through a multiplicity of bilateral ties in which the Supreme Audit Office is always one party" [6]. According to the Act on the Supreme Audit Office, the structures of the Supreme Audit Office include the President, three Vice Presidents, Director General, Controllers, Departments, Regional Branch, Offices and other service and administrative bodies. The structure of the Supreme Audit Office is explained in the Fig. 1.

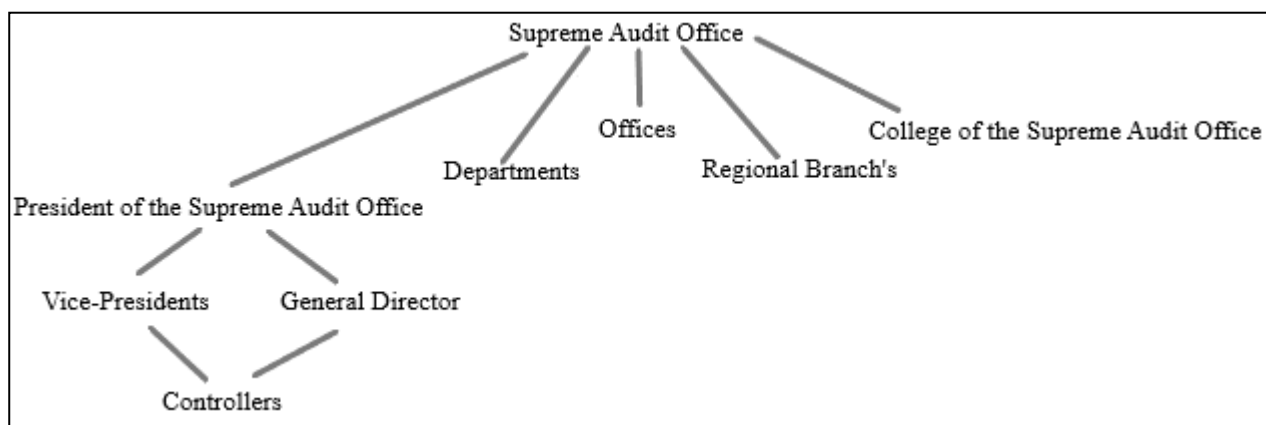


Fig. 1. Structure of the Supreme Audit Office

Source: own elaboration

### **President of the Supreme Audit Office**

The President of the Supreme Audit Office, who is the head of the Office, is appointed by the Sejm with an absolute majority of votes and the consent of the Senate. Before taking up his post for a term of six years, he takes the following solemn oath before the Sejm: "Upon assuming the position of President of the Supreme Audit Office, I solemnly swear that I will remain faithful to the provisions of the Constitution of the Republic of Poland, and that I will perform the duties entrusted to me impartially and with utmost diligence" [11]. The President of the Supreme Audit Office may not hold this position for more than two consecutive terms, although he may be dismissed in statutorily specified cases, including: resignation from the post, inability to continue to perform the function, conviction by a final court judgement, false declaration of assets, and a decision of the State Tribunal imposing a ban on occupying managerial positions or performing functions of particular responsibility in state bodies. The President of the Supreme Audit Office bears political responsibility before the Sejm and constitutional responsibility before the State Tribunal for his activities, and at the same time is covered by personal immunity. "The immunity enjoyed by the President of the Supreme Audit Office is a formal (procedural) immunity which does not constitute an obstacle to the commencement of civil proceedings or any other proceedings which are not criminal proceedings. [...] The President of the Supreme Audit Office is also entitled to controller's immunity, which covers official activities even after the end of his term of office (Article 88 of the Act on the Supreme Audit Office). Krzysztof Grajewski defines it as official formal immunity, which includes the prohibition of prosecution of professional activities arising from the Act on the Supreme Audit Office" [12]. Among the main postulates to be followed by the person assuming the position of the President are apoliticality and non-combination of positions with the exclusion of a university professor. The main tasks of the President of the Supreme Audit Office include resolving internal disputes between the

organs of the Supreme Audit Office, submitting a motion to the Constitutional Tribunal on entities legitimated in a general manner, submitting a motion to the Constitutional Tribunal to resolve a competence dispute, managing the entire Supreme Audit Office as a unity by issuing orders, participating in sessions of the Sejm, submitting a motion to take a position on the results of an audit carried out, giving consent to carry out an audit, as well as carrying it out on the basis of an official ID card. In its actions it is entitled to make public documents not covered by statutory protection and in its actions it has the possibility to grant post-control speeches [11].

### **Vice-Presidents of the Supreme Audit Office**

On the motion of the President of the Supreme Audit Office, the Speaker of the Sejm, after consulting the appropriate parliamentary committee, appoints and dismisses Vice-Presidents of the Supreme Audit Office. The Polish legislator stipulated that there should be three Vice-Presidents, who may substitute in their activities the tasks envisaged for the President. At the same time, like the President, they may not belong to political parties, hold any other position except that of a university professor, or conduct any public activity incompatible with the dignity of their position. The position of Vice President shall be incompatible with the mandate of a deputy, senator, member of the European Parliament or councillor. One of the Vice-Presidents indicated by the President co-chairs the deliberations of the Supreme Audit Office College. Other duties of the Vice-Presidents include the approval of ad hoc audits, they may individually carry out audits on the basis of an official ID card and are authorised to issue an audit authorisation. The Vice-Presidents cannot be held criminally responsible for their official acts without the prior approval of the College of the Supreme Audit Office [11].

### **General Director of the Supreme Audit Office**

The Director is appointed and dismissed by the President of the Supreme Audit Office with the approval of the Speaker of the Sejm. Similarly to the President and Vice-Presidents, he may not belong to a political party, hold any other position except that of a university professor, or perform any other activities that would undermine the dignity of the office of Director of the Supreme Audit Office. The post of Director may not be combined with the mandate of a deputy, senator, member of the European Parliament or councillor. The main powers of the Director General of the Supreme Audit Office include carrying out inspections on the basis of an official ID card, as well as streamlining the activities of the Supreme Audit Office. The Director General, like the Vice-Presidents, cannot be held criminally liable for his official activities without the prior consent of the Supreme Audit Office's College [11].

### **Controllers**

Controllers are employees of the Supreme Audit Office authorised to carry out inspections on the basis of a service card, and some of them on the basis of a service card and on the basis of an authorisation to carry out an inspection. They are appointed by the President of the Supreme Audit Office, who may terminate their employment relationship, with the appointment being conditional on a controller's application completed by passing an examination before an examination board. "Upon appointment, a controller shall take the following oath before the President of the Supreme

Audit Office: "I vow to serve the Republic of Poland, to observe the legal order, to perform the duties of an employee of the Supreme Audit Office conscientiously, impartially, to the best of my knowledge and will". The oath may also be taken with the addition of the words: "So help me God" [11]. The work of Controllers is subject to periodic qualification assessments, of which the law stipulates that such assessment may not be carried out less frequently than once every 3 years. Controllers may be excluded from the inspection proceedings at any time, upon their application or ex officio, if the results of the inspection could affect their rights or obligations or could affect persons associated with them. The scrutineer shall be provided with suitable conditions for carrying out the scrutiny. During his activities, he shall be authorised to move freely within the controlled unit without being required to obtain a pass and shall be exempt from any personal searches. The inspector is obliged to draw up acts of inspection, protocols and official notes in which, in general, the actual state of affairs is established. The inspector draws up an inspection report, which contains the entirety of the conducted inspection with appropriate signalling. A person who is entitled to be an inspector is a person who "is a citizen of Poland, has full capacity to perform acts in law and enjoys full public rights, has not been punished for a criminal offence committed through intentional guilt, has higher education; and has health conditions allowing for employment on a given position"[11]. An inspector cannot be a member of a political party, nor can a mandate of a deputy, senator, member of the European Parliament or councillor be combined with it. The legislator has provided that a controller may take up additional gainful employment after obtaining the consent of the President of the Supreme Audit Office.

### **College of the Supreme Audit Office**

The college consists of the President of the Supreme Audit Office as chairman, vice-presidents and the Director General of the Supreme Audit Office, as well as 14 members of the college. The members of the college, in the form of seven representatives of legal or economic sciences and seven directors of control organisational units or counsels of the President of the Office, are appointed by the Speaker of the Sejm at the request of the President of the Supreme Audit Office and after consultation with the relevant Sejm committee. Of the fourteen members of the college appointed by the Speaker of the Sejm, the President of the Supreme Audit Office appoints the secretary. The term of office of members of the college shall be three years, and shall expire in the event of a member's recall or death. A member of the college is recalled by the Speaker of the Sejm, at the request of the President of the Supreme Audit Office, in the following restricted situations: when the member resigned from the function, ceased to occupy the position to which he was appointed, did not participate in meetings of the college for a period exceeding one year, or was sentenced by a final court judgement for committing an intentional crime [11]. According to the legislator, the competence of the College includes: approval of the analysis of the execution of the state budget and the assumptions of the monetary policy and approval of the report on the activities of the Supreme Audit Office in the previous year. Its legislative powers include the adoption of: opinions on the discharge of the Council of Ministers, motions for the consideration by the Sejm of specific problems related to the activities of bodies performing public tasks, speeches containing audit allegations concerning the activities of persons comprising the Council of Ministers, the draft statute and draft budget, and the annual plan of the Supreme Audit Office [11]. The opinion-making competencies of the college

are closed in giving an opinion on control programmes and information on the results of particularly important controls or other matters brought by the President of the Supreme Audit Office or matters brought by at least one third of the members of the college [11].

### **Departments of the Supreme Audit Office**

In terms of the Supreme Audit Office, the legislature has provided for 14 department:

- 1) Department of Public Administration,
- 2) Department of Budget and Finance,
- 3) Department of Economy, Public Assets and Privatization,
- 4) Department of Infrastructure,
- 5) Department of Audit Methodology and Professional Development,
- 6) Department of Science, Education and National Heritage,
- 7) Department of National Defense,
- 8) Department of Public Order and Internal Security,
- 9) Department of Labour, Social and Family Affairs,
- 10) Department of Legal Affairs,
- 11) Department of Agriculture and Rural Development,
- 12) Department of Strategy,
- 13) Department of Environment,
- 14) Department of Health.

According to the Ordinance of the President of the Supreme Audit Office on the detailed internal organisation and competence of organisational units of the Supreme Audit Office of 29 August 2011, the joint competencies of the departments, with the exception of the Strategy Department, the Controlling Law and Jurisprudence Department and the Audit Methodology and Professional Development Department, cover control within the scope of matters covered by the activities of government administration, tasks performed by ministers responsible for sectors of government administration and the Prime Minister, as well as tasks performed by bodies, offices and units subordinated or supervised by ministers responsible for sectors of government administration [13]. The situation is similar as far as direct control over the execution of the state budget is concerned, only three departments do not have such competences; this limitation refers to the Department of Audit Methodology and Professional Development, the Department of Legal Affairs, and the Strategy Department. Pursuant to the Ordinance of the Prime Minister, exclusive competencies were reserved to each of the departments. The responsibilities of the Department of Public Administration include auditing the activities of the Central Statistical Office, internal audit tasks, the financial and property management of the Supreme Administrative Court and the Constitutional Tribunal, and the implementation of the financial plan of the "Central Vehicle and Driver Register Fund, the Accessibility Fund, the Compensation Fund, the Fund for Support of Public Benefit Organizations, and the Fund for Support of Civil Society Development" [13]. The Budget and Finance Department undertakes control over the activities of "the National Bank of Poland and the Office of the Financial Supervision Authority, the disposition of grants and subsidies by political parties and electoral committees, internal audit tasks, and the financial and property management of the Chancellery of

the President of the Republic of Poland, the Chancellery of the Sejm; the Chancellery of the Senate, the National Electoral Office, the Ombudsman, and the execution of the financial plan of the Reprivatization Fund" [13]. The competence of the Department of Economy, Public Assets and Privatization includes control over the activities of the "Office of Competition and Consumer Protection, the Polish Committee for Standardization, the Energy Regulatory Office, the General Prosecutor's Office of the Republic of Poland, the Agency for Industrial Development S.A., the Polish Development Fund S.A., the Polish Investment and Trade Agency S.A., revenues from privatization of Treasury assets, and execution of financial plans: Intervention Stocks Fund, Capital Investment Fund, Price Difference Payment Fund, Indirect Issue Costs Compensation Fund" [13]. The Department of Labor, Social and Family Affairs undertakes control over the implementation of financial plans: "Social Insurance Fund, Bridging Pension Fund, Demographic Reserve Fund, Guaranteed Employee Benefits Fund, Labour Fund, Solidarity Fund, State Fund for Rehabilitation of Persons with Disabilities, and the implementation of internal audit tasks and financial and property management of the State Labour Inspectorate and the Ombudsman for Children" [13]. The control of the Department of Infrastructure extends within the limits of the implementation of the financial plan: Geodetic and Cartographic Resources Management Fund, Public Utility Bus Transportation Development Fund, Local Government Roads Fund [13]. The Department of Legal Affairs inspects the preparatory work of "the Supreme Audit Office Collegium, provides legal assistance to control organisational units, provides legal opinions on draft control programmes and information on the results of control, provides opinions on and develops draft conclusions, prepares legal opinions and draft agreements on control matters, considers objections by the Settlement Commission, matters of drafting and agreeing on draft normative acts and other legal acts in the Supreme Audit Office, support of the Organizational Office, coordination of the Supreme Audit Office cooperation with the Sejm, the Senate and their bodies as well as with other state bodies concerning legislative work and implementation of de lege ferenda motions, and providing opinions on the control of draft agreements concluded with other state bodies and maintaining a register of such agreements" [13]. The control exercised by the Strategy Department relates to activities within the framework of "preparation of the strategy of the control activity of the Supreme Audit Office, development of draft work plans of the Supreme Audit Office and coordination of their implementation, carrying out ad hoc inspections and coordination of tasks of the organizational units of the Supreme Audit Office within the scope of carrying out ad hoc inspections, giving opinions on draft inspection programmes and information on the results of inspections, in particular in terms of their compliance with the work plan, post-audit submissions signed by the President of the Supreme Audit Office, strategic analyses, research, preparation of databases and reports and making analyses of the activities of organizational units, coordination and execution of internal reporting and preparation of reports on the activities of the Supreme Audit Office and a type of similar undertakings" [13]. The Department of Audit Methodology and Professional Development has extensive competences in the scope of support of control organisational units, for example "support in implementation of control methodology and assistance in use of tools used for preparation and conducting control, support control units in use of available resources and IT tools for control purposes, analysis of control quality and development of control quality management methodology, issuing opinions on draft work plans and programmes of control and information on the results of control, development of principles for creation of individual



career paths of employees and principles for supervision of their implementation, development and management of the system for improvement of professional qualifications of employees of the Supreme Audit Office, development and implementation of programmes of controller's application, training plans and other forms of professional development" [13]. The audit activity of the Department of Science, Education and National Heritage is closed in the execution of financial plans: "Fund for Promotion of Culture, Fund for Development of Physical Culture, Fund for Sports Activities for Pupils, National Fund for Protection of Monuments, as well as control of implementation of internal audit tasks and financial and property management of the National Broadcasting Council" [13]. In the Department of the Environment, the audit conducted concerns the "implementation of the financial plan of the National Fund for Environmental Protection and Water Management and the State Water Management Company Polish Waters [13]. The Department of Agriculture and Rural Development undertakes control over financial plans: Pension Fund, Prevention and Rehabilitation Fund, Administrative Fund" [13]. The competencies of the Department of Public Order and Internal Security include controlling matters covered by the "activity of the General Prosecutor and the prosecutors subordinate to him, the Internal Security Agency, the Foreign Intelligence Agency, the Central Anti-Corruption Bureau, and execution of financial plans: Fund for Victims' Assistance and Post-Penitentiary Assistance - Justice Fund, Fund for Professional Activation of Prisoners and Development of Prison Labour Institutions, Fund for Public Security Modernization, Police Support Fund, Border Guard Support Fund, State Fire Service Support Fund, as well as realization of internal audit tasks and financial and property management: Supreme Court, National Council of the Judiciary, Office for Personal Data Protection, Institute of National Remembrance - Commission for the Prosecution of Crimes against the Polish Nation" [13]. The Department of National Defense most extensive audit powers relate solely to the implementation of the financial plan for the Armed Forces Modernization Fund [13]. The Department of Health performs control within the framework of execution of financial plans: National Health Fund, Gambling Problem Solving Fund, Medical Fund [13].

### **Regional Branches and Department's of the Supreme Audit Office**

These include audits of the implementation of a part of budgets by relevant provinces and the implementation of a part of budgets by relevant local government appeals boards in units located in province covered by the territorial jurisdiction of a given delegation [13]. The headquarters of the Supreme Audit Office is located in the capital city of Poland - Warsaw. Regional Branches are located in accordance with the administrative division of Poland at the provincial level, which means that there is one Supreme Audit Office delegation per province. Four organizational and internal service units were created within the Supreme Audit Office: Facilities and Logistics, IT, Corporate Services and Accounts. Each of the offices is tasked with carrying out tasks in the area of implementation and servicing of the functioning of the Supreme Audit Office, with the reservation that each of the offices is entitled to different categories of activities appropriate to the service scope indicated in the regulation.



## **International cooperation of the Supreme Audit Office**

The Supreme Audit Office in its activities undertakes cooperation with numerous supreme audit institutions from other countries, with international institutions and with audit institutions in Europe and worldwide [3]. "The Supreme Audit Office may conduct joint audits with the European Court of Auditors . Article 12a of the Act on the Supreme Audit Office, which generally stipulates that the Office may conduct audits jointly with the audit bodies of the European Communities and the chief audit bodies of other countries, and the principles and scope of conducting audits shall be determined by an agreement concluded by the Supreme Audit Office with these bodies. The rules of the Supreme Audit Office's participation in the audit conducted by the European Court of Auditors in Poland are each time determined by both institutions. If the Supreme Audit Office will participate in the audit conducted by the European Court of Auditors , it must carry it out on the basis of the provisions of the Act on the Supreme Audit Office" [14]. An additional effect of the cooperation is the unification and improvement of standards, good practices, experience and by raising the overall quality of the activity of state chambers of audit. The Supreme Audit Office is a member of the organization: INTOSAI – "an organization that develops international standards for supreme audit institutions (ISSAI), methodologies for various areas of audit, provides training, facilitates the exchange of information and experience among its members" [3], EUROSAI [European Organization of Supreme Audit Institutions] – "the organization mediates the exchange of information on external state control, participates in the development of international audit standards and organizes training for auditors, and the Supreme Audit Institution serves as the Vice-Chairman of the EUROSAI Board" [3], Contact Committee – "a body consisting of the heads of the Supreme Audit Institutions (SAIs) from the European Union member states and the European Court of Auditors (ECA). The main objective of the Committee is to strengthen cooperation between its members in order to improve external audit and accountability in matters related to the European Union" [3], European Court of Auditors – "a Luxembourg-based body charged with checking the legality and regularity of all EU revenue and expenditure and the sound management of EU finances". [3], Supreme Audit Institutions of Europe - "The Supreme Audit Institution maintains permanent working relations with almost all of the Supreme Audit Institutions of Europe, in particular with the Supreme Audit Institutions of Central Europe [...] The institutions exchange their experiences, organize training and undertake joint audits" [3]. Audit of International Organizations- a body dedicated to external audits, the Polish Supreme Audit Office served as the external auditor of the European Organization for Nuclear Research CERN for the period 2013-2017. Currently, the Supreme Audit Office has its representatives in the College of External Auditors for the period 2021-2024 and in the Audit Committee of the European Space Agency for the period 2020-2024 [3].

## **Conclusions**

The Supreme Audit Office is a key body for the control of state finances due to its essential features provided for in legal acts. The most important features of the Supreme Audit Office include the collegial activity of the body, its statutory authority to carry out audits while maintaining the specific duties of the audited body. Further specific features include the specialised requirements for

membership of the body and election of its President, the independence of the body, its limited subordination only to the Sejm of the Republic of Poland, whereby it is the President who is responsible to the Sejm for the activities of the Office. Important specific features also include extensive international cooperation between states and international organisations, and the adoption of a semi-decentralised system of distribution of the national structure. Beginning with Poland's regaining of independence and continuing through the period of Poland's full democracy until 1989, the Supreme Audit Office was subject to numerous modifications not always beneficial to the independence of this body. In 21st century Poland, a democratic country, the Supreme Audit Office occupies the prime position in the important mission of protecting and controlling state finances. Through its duties in relation to the legislative body, which is the Sejm of the Republic of Poland, it directly participates in the process of recognition and approval of the state budget, and coordinates and improves its control activities. The Supreme Audit Office performs its control function from the point of view of legality, economy, expediency and reliability by controlling and supporting the activities of all subordinate bodies connected with state funds. The Office conducts its audit proceedings on the basis of the principles of objectivity, legality, material truth, adversarial principle, written procedure and efficiency. The structure of the bodies of the Supreme Audit Office consists of the President, three Vice-Presidents, the Director General, Controllers, control units - including departments and delegations, organisation and service units comprising four offices and the College consisting of the President of the Supreme Audit Office as Chairman, Vice-Presidents and the Director General of the Supreme Audit Office and fourteen elected members. "The Office cannot be assigned to any of the three classically conceived elements of power: it is not an organ of legislative power, although it is linked to the Sejm and cooperates in the implementation of the control function of the Sejm; it is not an organ of judicial power, because it is organised in a uniform clerical structure and operates on the basis of procedures typical rather of administrative bodies; finally, it is not an organ of executive power, although almost all of its activities concern the functioning of government and administration" [4].

## Literature

- [1] J. Mazur. J. KP., (2015), Vol. 60, 8-27.
- [2] R. P. Krawczyk. J. Folia Iuridicia, (1991), Vol. 45, 75-89.
- [3] *O NIK 2020*,  
<https://www.nik.gov.pl/o-nik/historia-nik/tradycje-kontroli-panstwowej.html>, 19.06.2021.
- [4] L. Garlicki, *Polskie prawo konstytucyjne zarys wykładu*, Warszawa: Wolters Kluwer 2020.
- [5] Konstytucja Rzeczypospolitej Polskiej (Dz.U. 1997 nr 78 poz. 483, with later amendments).
- [6] L. Murat. J. PS., (2019), Vol. 3(152), 61-79
- [7] W. Kotowski, B. Kurzepa, *Komentarz do niektórych przepisów ustawy o Najwyższej Izbie Kontroli, [w:] Wykroczenia pozakodeksowe. Komentarz, wydanie II*, Warszawa: LexisNexis 2008.
- [8] K. Kubuj. J. PS., (2007), Vol. 78, 21-34.
- [9] P. Szustakiewicz. J. Ius Novum, (2008), Vol. 3, 139-151.

- [10] A.Gajda, J. Juchniewicz, P. Uziębło, A. Rytel Warzocha, *Prawo Konstytucyjne Diagramy*, Warszawa: Wolters Kluwer 2014.
- [11] Ustawa o Najwyższej Izbie Kontroli (Dz. U. 1995 Nr 13 poz. 59, with later amendments).
- [12] A. Kalinowska-Wójcik. J. PS., (2017), Vol. 3(140), 7-20.
- [13] *PODSTAWY PRAWNE DZIAŁANIA NIK 2021*,  
<https://bip.nik.gov.pl/podstawy-prawne-dzialania-nik/akty-prawne/zarzadzenie-w-sprawie-szczegolowych-zasad-przygotowywania-kontroli.html>, 14.07.2021
- [14] M. Berek, E. Jarzęcka-Siwik, B. Skwarka, Z. Wrona, *Najwyższa Izba Kontroli i prawne aspekty funkcjonowania kontroli państwowej*, Warszawa: Najwyższa Izba Kontroli 2018.

## PHYSIOTHERAPY IN SURGICAL TREATMENT OF COLORECTAL CANCER – PROPOSED MANAGEMENT METHOD PNF

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### Abstract:

Physiotherapy in the surgical treatment of colorectal cancer should be implemented before the surgery. The available scientific reports show that greater mobility before surgery has a positive effect on the surgical procedure by reducing postoperative complications. The literature review also shows that people with normal body weight have fewer complications after surgery and their recovery time is shorter, which has a positive effect on the patient's mental sphere. Post-operative depression is less frequent in people who returned to everyday activities after surgery on day 2. After analyzing the existing literature, it can be concluded that the level of fitness before the surgery has a significant impact on the level of reduction in the mobility of the patient after the surgery. In order to, increase the level of the patient's fitness, it should be improved before the surgery. In addition, the patient should be instructed before the procedure about the necessity and manner of exercise, so that after the surgery, from the first day, you can experience physical therapy.

### Keywords:

*rehabilitation, depression, disability*

### Introduction

The problem of rehabilitation of cancer patients is still a neglected issue, there is a shortage of staff educating patients in cancer departments. Colorectal neoplasms are responsible in the world for 8% of cancer deaths, which is the fourth most common cancer cause of death in the world, causing about 600,000 deaths (8%) annually. Mortality is lower in women than in men [1].

After the age of 50, the incidence of gastrointestinal neoplasms increases very quickly with each subsequent decade.

At the same time, in the most threatened age groups, cardiovascular and respiratory diseases as well as other organs important for life are a serious burden, which significantly limits the efficiency of the system [1, 2].

It is estimated that as many as 80% of people over 65 are affected by at least one cardiovascular or respiratory disease. This clearly shows the scale of threats to which patients are exposed to malignant tumors.

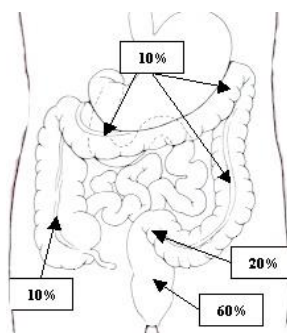


Fig. 1. Occurrence of cancerous lesions in the large intestine

Source: P. Tuchowska, H. Worach-Kardas, T. Marcinkowski, Najczęstsze nowotwory złośliwe w Polsce – główne czynniki ryzyka i możliwości optymalizacji działań profilaktycznych, Problemy Higieny i Epidemiologii, (2013), Vol. 94, 166-171

This is not the only problem in this group of patients.

Physical and mental fitness decreases with age, therefore the treatment of the underlying disease may be limited by the presence of comorbidities, or the comorbidity will cause failure of the underlying disease.

The method of treating colorectal cancer depends on the stage of the disease at diagnosis.

Surgery is always the basic treatment method for colorectal cancer and should be considered in any case.

At the same time, it should be emphasized that surgery is not always possible, and sometimes it should be postponed - after completing the use of other, initial (so-called neoadjuvant) methods of treatment.

Due to the surgical treatment and traumatization of the therapy, exercises can be used in the first days after surgery, if there are no contraindications for performing kinesitherapy.

The selection of exercises depends on the operating method and the patient's condition.

In most cases of colorectal cancer, however, it is necessary to resect the tumor together with a fragment of the colon. This procedure is performed under general anesthesia. It is usually performed by cutting the abdominal skin 15-30 cm long [3].

In recent years, attempts have been made to cut out parts of the colon with cancer using a laparoscope. The decision about the possibility of such surgery depends on the size and location of the tumor, comorbidities and patient preferences [4]. Publications assessing the possibility of performing laparoscopy in cases that until recently, were considered to be reserved for open surgery due to the patient's severe general condition can be considered very important. It was shown that the number of complications, mortality, and the need for repeated hospitalizations were similar, but hospital stay after laparoscopy was clearly shorter [5].

Researchers have concluded that age cannot be treated as a contraindication to laparoscopic colon surgery, and should even be considered an indication for the use of this technique [4].

The best quality of life for patients should be ensured at every stage of treatment. The improvement process should take place in parallel with the treatment process, as it is its component.

Due to surgery, we can distinguish as side effects:

- change in posture - caused by a scar within the abdominal wall affecting the mobility of the spine,
- restriction of mobility in the joints of the rim of the upper limb,
- decrease in muscular strength in postural muscles.

Physiotherapeutic procedures should be adapted so that it would act comprehensively, on all adverse effects.

Due to the fresh surgical scar, exercises involving the torso directly are inadvisable. Using the PNF (proprioceptive neuromuscular facilitation) method, we can indirectly affect structures located in the operated area.

Available literature focuses on anti-edema prevention in the first phase after surgery.

## **Review of the literature**

The method of treating colorectal cancer depends on the stage of the disease at diagnosis.

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The selection of exercises depends on the operating method and the patient's condition.

## **Literature review**

Existing studies do not present the use of the PNF method in the rehabilitation of people after surgical treatment of colorectal cancer. The literature describes the PNF method mainly in neurological dysfunction studies.

## **Use of the method after surgical treatment of colorectal cancer.**

Due to the surgical treatment and tissue traumatization, the therapy, by applying the main principles - the selection of the appropriate technique and irradiation, and the philosophy - painless exercises can be used in the first days after surgery, if there are no contraindications for performing kinesitherapy. During therapy, you should first determine its purpose. For this purpose, we can use the ICF classification [6].



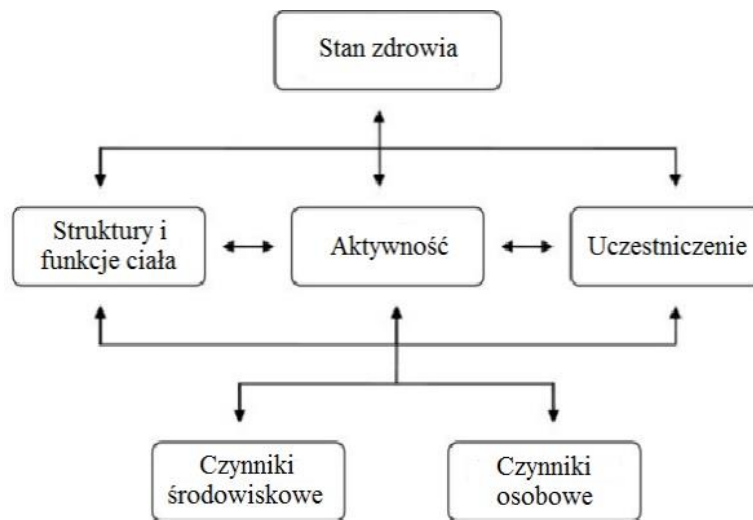


Fig. 2. ICF procedure and classification

Source: E. Górna, Proprioceptive neuromuscular facilitation, Skrypt kursu rozwijającego PNF, 2016

### Proposed therapy

The patient's rehabilitation method can be divided into four stages:

- preoperative,
- acute(until upright),
- subacute,
- chronic.

In the preoperative phase, in the case of oncological procedures, these are usually planned procedures, it is possible to prepare the patient physically for the procedure. For this purpose, general rehabilitation exercises are used, which mainly improve the flexibility of the abdominal muscles and increase their strength, but also breathing exercises.

In the acute phase, i.e. directly after surgery, the rehabilitation procedure is aimed at preventing venous stasis and improving the quality of breathing.



Fig. 3. Moving the upper torso

Source: own picture

In the first stage after surgery, it is recommended to use techniques in which there is no movement but isometric muscle tension.

Own observations also show that the use of positioning positively affects the recovery of fitness. By correctly positioning the patient, you can affect the elasticity of the scar, which is a key element for further rehabilitation.

Changing position, i.e. transfer in the first days after surgery, is a factor causing pain to the patient and causing discomfort. Self-attempting to change the position causes the patient pain, which occurs through the abdominal muscles. The therapist through facilitation-paving, is able to relieve the patient and make a move without the occurrence of pain sensations. For this purpose, by raising the head, the patient stimulates the abdominal muscles to tension, and the therapist, by relieving movement through the facilitation of the shoulders, sets the direction of movement (Fig. 3).

When moving the lower torso, pelvic floor tension, hip extensors, lower abdominal muscles occur. To support movement, the therapist relieves and directs movement through the grip on the trochanter of larger hip bones. Each time the patient changes position he initiates movement (Fig. 4).



Fig. 4. Moving the lower torso

Source: own picture

In the subacute phase, when the patient undergoes verticalisation, orthostatic reactions are the most important. After immobilization after surgery, orthostatic disorders are a common complication, especially in the elderly. Emphasis should be placed on anticoagulant exercises and stimulation of deep sensation.

In this phase, the mobilization of the scar is equally important, especially when the surgical incision has healed. For this purpose, a scar is developed using fascial mobilization techniques to make the abdominal skin more flexible and restore tissue slippage. Head patterns can be used to increase abdominal muscle tone. By raising the head, the chin is directed to the sternum and the patient rotates through the flexion pattern headache causes tension in the abdominal muscles. Rotation involves the muscles obliquely on the side where it is made (Fig. 5).



Fig. 5. Facilitation of the abdominal muscles through the flexion pattern of the head  
Source: own picture

## Conclusions

1. Rehabilitation after surgery is necessary to reduce postoperative complications.
2. Rehabilitation should be started in the pre-operative phase.
3. The PNF method can be used in any phase of patient rehabilitation after surgical treatment of colorectal cancer.
4. During therapy, the goal of rehabilitation should be determined and the patient's abilities determined.
5. The goal of rehabilitation should be preceded by diagnostic tests.
6. We should not include physical therapy in rehabilitation.

## Literature

- [1] P. Tuchowska, H. Worach-Kardas, T. Marcinkowski, Najczęstsze nowotwory złośliwe w Polsce – główne czynniki ryzyka i możliwości optymalizacji działań profilaktycznych, *Problemy Higieny i Epidemiologii*, (2013) Vol 94, 166-171.
- [2] G. Ceccarelli, A. Biancafarina, A. Patriti, et al, Laparoscopic resection with intracorporeal anastomosis for colon carcinoma located in the splenic flexure. *Surg. Endosc.* (2010) Vol. 24,1784–1788.
- [3] DP. Geisler, E.T. Condon, F.H. Remzi, Single incision laparoscopic total proctocolectomy with ileopouch anal anastomosis. *Colorectal Dis.*, (2010) Vol. 12, 941–943.
- [4] Y. Fukunaga, M. Higashino, S. Tanimura et al. Laparoscopic rectal surgery for middle and lower rectal cancer. *Surg. Endosc.*, (2010) Vol. 24, 145–151.
- [5] S. Adler, D. Beckers, M. Buck, *PNF w Praktyce. Ilustrowany przewodnik*, Warszawa: DB Publishing 2009.

- [6] E. Górna, *Proprioceptive neuromuscular facilitation*, Skrypt kursu rozwijającego PNF, 2016
- [7] R. Horst, *Trening strategii motorycznych i PNF*, Biały kościół: Top School 2010.
- [8] H. Kabat, M. Knott, *Proprioceptive facilitation techniques for treatment of paralysis*, Philadelphia: Lippincott Williams & Wilkins 1953.

## **VALUATION OF THE NEO-GOTHIC CHURCH OF THE GOOD SHEPHERD IN THE KARB DISTRICT OF BYTOM, BASED ON AN ANALYSIS VALUING WALTER FRODEL**

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### **Abstract:**

The historical value analysis (ZAW for short) aims to indicate the main values of a given architectural monument. Among them, historical, artistic and functional values should be mentioned. In historic sacred architecture, these values are often combined with symbolic and memorative content. ZAW is the basis for making decisions related to conservation work, greater care and protection of a given monument. The aim of the article is to indicate the values that are represented in the neo-Gothic church of Good Shepherd in the Bytom district of Karb. Since the mid-twentieth century, this facility has been systematically damaged as a result of mining damage. The valuation of the temple in Karb using the ZAW research method is the first attempt of this type, and the values recognized and described in the article confirm the need for further conservation work on this church and its preservation for future generations.

### **Keywords:**

*monument, valuation, values, sacred architecture*

### **Admission**

A monument, which in the light of the 2003 Act and its subsequent amendments, is defined as real estate or a movable object, which is a product of man or related to his activity, and also bears witness to past times or events, which very importantly carries the values, thanks to which his behavior is in the public interest [1]. They may be related to its history, artistry, or continuum of functions. Most of the historic buildings of sacred architecture combine the above-mentioned features. Additionally, they are emphasized by a symbolic meaning as well as an emotional charge. It should be noted that the correct recognition of the value of a monument is not only some help in undertaking any conservation works, but also an introduction to its further, in-depth protection.

A detailed study of the values represented by a given object, including sacred architecture, is possible thanks to the historical value-based analysis, a method in short known as ZAW. Marian Arsyński was the first to use this term, and now it is widely used in the Polish conservation community [2]. The theoretical foundations of the historical value-added analysis had already been

developed by two scholars of merit in conservation - Alois Riegl (1858-1905), and, above all, the continuator of his views - Walter Frodl (1908-1994) [3].

Alois Riegl, an Austrian art historian and conservator, a representative of the so-called Viennese School, laid the foundations for the historical value-added analysis. In a slightly toned style, he followed the idea of John Ruskin (1819-1900), who wanted the monuments to be preserved in the same condition as they had survived, and he considered restoration works to be a kind of forgery. In this way, he stood in opposition to Eugène Viollet-le-Duc (1814-1879), a supporter of stylish purity and promoter of a purist approach to the monument, and thus removing the historical layers that arose in it. Alois Riegl raised the issue of the values that inspire to respect and protect monuments. He also authored the classification of monuments and the systematics of values, in which he distinguished values of commemoration and contemporary values. He divided the commemorative values into monumental, historical and ancient. The contemporary values were segregated into artistic (relative artistic value and novelty value) and functional values. He described his views in the book *Der moderne Denkmalkultus*, published in 1903. More than sixty years later, the value system developed by Riegl was interpreted by Walter Frodl, a distinguished Austrian art historian, conservator, professor at universities in, among others, Vienna, Istanbul and Rome, long-term president of the Austrian Federal Office for the Preservation of Monuments. Based on the systematics of the author's values, *Der moderne Denkmalkultus*, he developed his own, in which he distinguished three main values - historical, artistic and functional, divided into next ones. In 1966, the lectures given at the University of Rome three years earlier, containing Frodl's views, were published by the Library of Museology and Monument Protection [4].

## **Neo-Gothic Roman Catholic parish church of Good Shepherd in the Bytom district of Karb**

Neo-Gothic church of Good Shepherd was built in the first decade of the 20th century, according to the design of Maximilian Sliwka (1871-1940), an Upper Silesian builder and architect, cooperating with another renowned architect of that period, Ludwig Schneider (1855-1943) [5]. The construction work was led by master Paul from Karb.

The temple has an irregular plan on a plan similar to the Latin cross, and its fragmented body is dominated by two towers and a three-nave, pseudo-basilica body with a transept. The uniqueness of this temple listed in the register of monuments lies in the combination of a neo-Gothic style with elements of modernism and the use of modern technology, including "Rabitz" type vaults. The church is the most magnificent building in Karb – first a workers' colony, then a municipal commune, and now one of the districts of Bytom. It is part of a large group of neo-style Roman Catholic parish churches built at the turn of the 19th and 20th centuries in Upper Silesia. The construction of new churches was associated with the transformation of previously small workers' colonies into thriving centers, whose inhabitants took up jobs in the dynamically developing heavy industry, based on the exploitation of carbon deposits.

The church of the Good Shepherd has been the liturgical and social center of Karb since its inception. However, already at the turn of the 1950s and 1960s, the temple began to regularly experience the impact of the degrading effects of mining damage, which forced the undertaking



of numerous renovation and restoration works. The most important of them were conducted in the 1980s. They consisted, inter alia, of on the reinforcement of the foundations by anchoring with a system of longitudinal members and transverse reinforced concrete ties, running along the axis of the nave bearing pillars. Under the vaults, the heads of the brick pillars were gripped with steel struts, similarly with steel, external clamps, led on three levels around the perimeter, the higher parts of both towers were anchored. During renovation works, the progressive degradation of the "Rabitz" vaults was also dealt with. After three decades, the present state of preservation of the church is again alarmingly bad and requires urgent, extensive construction and restoration efforts.

The temple on Karb, due to its artistic, historical and emotional values, should be cared for and protected. It is an example of the development of neo-style religious architecture in Upper Silesia, and for the local population, for whom it is a centre of worship and a reminder of the rich history of the district.



Fig. 1. Bytom-Karb. Church of Good Shepherd. General view.  
Source: own photo



Fig. 2. Bytom-Karb. Church of Good Shepherd. View of the facade. The photo was taken during the protection of the upper parts of the towers and the main entrance to the church against further degradation due to mining damage.  
Source: own photo



Fig. 3. Bytom-Karb. Church of Good Shepherd. View of the interior from the music gallery towards the presbytery.  
Source: Archives of the Good Shepherd Parish in Karb

## Historical and scientific value

Janusz Krawczyk, who is associated with the Toruń scientific community, discussing in detail the assumptions of the system of values in Frodl, points out that the system developed by the Viennese conservator is divided into three basic values, which he then complements and develops himself [2]. This division will be used to make a historical, value-added analysis of the Good Shepherd church in Karb.

The first of the three fundamental values is historical value. It refers to the documentary nature of the monument and shows how it influences the enrichment and development of universally understood historical knowledge. Historical value according to Frodl is divided into scientific and emotional. Updating this systematics in his article, Janusz Krawczyk talks about historical-scientific as well as historical-emotional value [2].

The degree of historical and scientific value depends primarily on the suitability of a given monument as a material for scientific research in various disciplines. These include, but are not limited to, art history, history of architecture, history of building techniques, social and host history, as well as the history of the region. This value is also related to the reliability of a given object. A monument, especially an architectural one, in which it is possible to indicate the layers associated with the various phases of its creation, transformations and restorations made, can be treated as authentic. Thanks to this, all information it provides contribute to the development of knowledge about the past and, what is equally important, does not lead to its falsification.

This value is linked to others, especially authenticity and integrity. They are important for the protection and care of the monuments. Their recognition is the basis for taking actions aimed at preserving a given object, treated as a cultural good, which may testify about the past for future generations. Depriving an object or greatly diminishing its authenticity value causes the loss of its monumental character. Reducing the value of integrity deprives it of its uniqueness, semantic premises and the related historical and cultural context. This way a general reduction in the level of values regarding the monument occurs and its importance happen not to be recognised [6]. Therefore, authenticity reveals the truthfulness, credibility and originality, as well as compliance with the tradition and history, culture and heritage of a given monument, inscribed in the context of its immediate and further surroundings. Integrity is a defined, inviolable and indivisible whole of a given object.

The neo-Gothic church building in the Karb district of Bytom has a high historical and scientific value. As a sacred building raised in the first decade of the twentieth century, it is part of

a much larger group of neo-style churches built at the turn of the nineteenth and twentieth centuries in Upper Silesia. Thanks to this, the church becomes an element of the rich history of the region, in a narrower spectrum - the cities of Bytom and Karb, first a workers' colony, then an urban commune, and finally one of Bytom's districts. The church towering over Karb is the most important monument of the district, focusing its history. The body of the building and the functional and spatial arrangements, as well as the material and structure, architectural details and decorative solutions of the interior, as well as the largely original equipment from the first decades of the last century, are an excellent source of information for researchers of the history of neo-Gothic architecture, especially neo-Gothic and general art history. The use of "Rabitz" vaults and their reinforcement in the 1980s with epoxy resin is a testimony to the development of building techniques and conservation practices. Similarly, strengthening the foundations or metal ties fastening the interior of the temple. Even though in over a century of history the building has not changed its shape or functional and spatial arrangements, numerous traces of many conservation and renovation works conducted therein, perfectly noticeable in the material structure of this monument, show the subsequent phases and stages of these activities. Thanks to this, its authenticity is confirmed. The historical and scientific value is also enhanced by the fact that the original architectural designs of the church has been preserved. Their analysis enables to capture changes in the construction concept, which enriches the knowledge about the history of the building. The question of the designer and builder of the church is also important. The figure of the Zabrze construction master Max Sliwka, professionally connected with the famous Silesian architect of the turn of the 19th and 20th centuries – Ludwig Schneider - requires an in-depth study. Undoubtedly, however, the fact of the authorship of the project of the Karb temple, confirmed by his signatures on construction projects, allows for a comparative analysis of this object with others on which Sliwka worked, as well as with a large group of churches designed by Schneider. The figure of the master Paul from Karb, who oversees construction works, is also not fully recognized. The need to embed it, not only in the process of creating the church of Good Shepherd, but also the urban development of Karb, open a wide field of research for researchers, especially historians. Thanks to this, the state of knowledge about the monument itself, the history of the district in which it is located can be developed, and information about the sacred, neo-style architecture of Upper Silesia and the urban development of the present Bytom, especially Karb itself, will be provided. It should be noted, however, that the lack of specific information, as well as the negative effects of archival inquiries regarding Sliwka and Paul from Karb, relatively contribute to the reduction of the discussed value.

The above-mentioned components of the historical and scientific value of the described object allow also for the recognition of a high level of its authenticity and integrity. The authenticity is emphasized by the preservation of the original substance - walls, roof truss, "Rabitz" vaults, door carpentry or architectural details as well as elements of the composition and interior design. They authenticate the monument itself, its history to date and the sacred function inscribed in it. The integrity of the monument is emphasized by its wholeness and indivisibility, which are visible in the projection and body, and have lasted from the very beginning of the building's existence. As a result, in general perception, it gives the impression of a coherent work. Although it is included in a wider group of neo-style churches of Upper Silesia, to be more precise, funded by local industrial tycoons or the local community, mainly workers of mines and steel mills, it is unique in itself due to

the construction solutions used, simplified architectural detail or the structure of the roof truss and bell.

All this allows for the indication of the historical and scientific value as one of the best represented in the facility and at the same time absolutely worth further sustaining and developing.

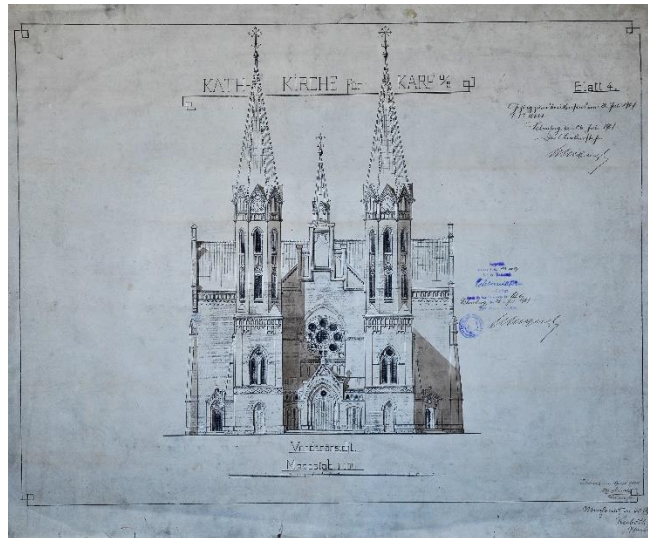


Fig. 4. Bytom-Karb. Archival drawing of the church under the invocation of Good Shepherd. Design by Maximilian Sliwka from 1906. View of the eastern façade.

Source: Archives of the Good Shepherd Parish in Bytom-Karb

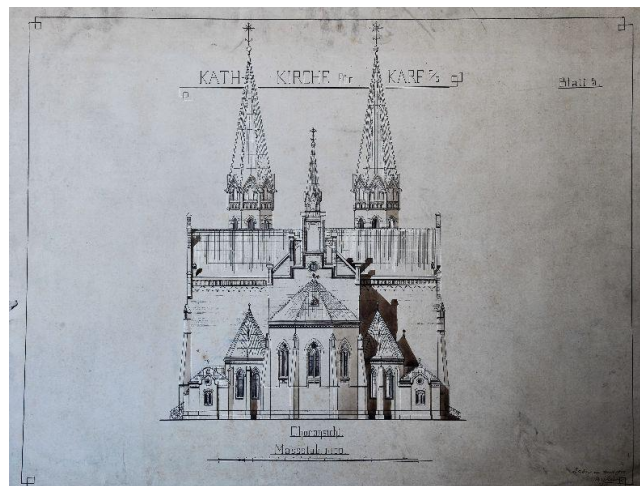


Fig. 5. Bytom-Karb. Archival drawing of the church under the invocation of Good Shepherd. Design by Maximilian Sliwka from 1906. View of the west elevation.

Source: Archives of the Good Shepherd Parish in Bytom-Karb

## Historical and emotional value

Historical and emotional value is related to the significance of the monument that accompanies it in the space of social life. Considering it, on one hand, it is possible to analyse the current state of preservation of the object, which also shows itself through the feeling of antiquity, thanks to patina and layers. On the other hand, historical events and people who left their mark on the monument



under study can be considered. Janusz Krawczyk points out that: *monuments that have become the carriers of collective identity have a high historical and emotional value* [2]. The author specifies that such a social group may be residents of a given town, district, region, as well as people belonging to some ethnic, professional, or religious community. Therefore, it is necessary to reflect and assess whether the valued object plays the role of a symbol for a social group.

Regarding the church building in Karb, the historical and emotional value is clearly noticeable and should be considered as high. The local community associates the building as a center of over a century of religious worship, sacraments and sacramentals – from baptism, through the Eucharist, marriage, to funerals and personal religious practices of the residents of the district, from the first decade of the last century to the latest times. It should be noted that in the monument in question, the historical and emotional value is raised mainly by the factor of the sacred nature of the place and the local center of the multidimensional presence of the Catholic Church. It is multiplied by the personal experiences and blood ties of the current residents of the district with its former residents. This value is strengthened within the analysed facility, also by the regional, national and global events that affected it. Among them, it is necessary to point out first the national friction related to the situation of Upper Silesia, including Karb, after World War I, a plebiscite intended to divide these lands between reborn Poland and Germany, and three Silesian uprisings. Then for the period of World War II, until the end of the decade of functioning in the socialist system. The building also evokes the memory of the priests who served in it, who also went down in the history of the town and region and their associates. It is also connected with the activities of the Congregation of the Franciscan Sisters, which in its shadow, from the very beginning, conducted and carry out charitable and educational activities.

## **Artistic value**

The artistic value is listed as the second in Walter Frodel's system. It focuses on the perception of a monument as a work of art. It analyses the style, quality and impact of a given object. What is important, it examines them as such, without being linked to historical values and their function at different times. The artistic value, like the historical value, is internally divided. Frodl distinguished historical and artistic value, artistic quality and artistic impact which, in his opinion, may be independent and non-self-existent. The author of the article *Dialogue with Tradition in Conservation - the Concept of Historical Valuation Analysis*, based on the systematics of the Viennese, updated this division, detailing the artistic and aesthetic value [2].

The artistic value of an architectural monument, writes Janusz Krawczyk, considers *the skillful combination of functional and structural aspects as well as the level of composition and decorative solutions* [2]. To determine it, it may also be helpful to consider the design on which a given structure was built.

Concerning the Good Shepherd Church, the artistic value is being considered in a broader regional context, especially the proximity of the monuments of the Upper Silesian agglomeration, particularly Katowice, Gliwice, Bytom or Tarnowskie Góry, does not seem to be the leading one. However, this assessment changes when the area of influence of the described structure is narrowed down to the Karb district itself. Undoubtedly, the building skillfully combines functional and

constructional aspects. In addition, this facility is the only one in the district with such an impressive form and an extensive architectural decoration program on the facades. Thus, its artistic value for this part of the city is extremely high. Undoubtedly, it also manifests itself in the above-mentioned by Janusz Krawczyk skills of combining various aspects, including functional and constructional ones, with the level of composition and applied decorative solutions. The functional and spatial arrangement of the building meets both liturgical and purely functional requirements. It is also the result of the technical, material and economic possibilities of the founders and later users of the building. "Rabitz" vaults, architectural detail in the form of simplified tracery, portals, cornices, rosettes, plastered blinds, ceramic facade decorations, as well as authentic neo-Gothic sculptures, both free-standing and groups, altar settings, pulpit, baptismal font, confessionals, orifice road stations or ceramic decoration of the walls in the naves - all these elements enhance the artistic value of the object and are valuable in themselves and worth preserving ruthlessly, not only from the artistic point of view, but also from the historical and conservation point of view. They are a combination of the skills of local craftsmen and builders, as well with Polish and German workshops, known in the first decades of the 20th century, using the construction and artistic and stylistic solutions commonly used at that time. Thanks to this, the church in Karb can be considered in a wide spectrum of similar implementations of the region, and even in a supra-regional perspective. The object's artistic value is significantly negatively affected by its poor state of preservation, mainly related to the effects of mining damage and the effects of weather conditions, which it still experiences. They translate into significant damage and loss of architectural detail of the facade or numerous cracks, which are also visible in the interior.



Fig. 6. Bytom-Karb. Church of Good Shepherd. Interior view from the center of the nave towards the north aisle. Visible inter-nave pillars with figures of the apostles, decorative brick cladding, pointed window openings, vaults, and steel reinforcements under the vaults.

Source: own photo





Fig. 7. Bytom-Karb. Church of Good Shepherd. View of the interior from the presbytery to the music hall and the main entrance. Visible inter-nave pillars with figures of the apostles, decorative brick cladding, pulpit, vaults, as well as steel reinforcements under the vaults.

Source: own photo

## Aesthetic value

The aesthetic value derives its message from the experience provided by the contact with the monument. As Janusz Krawczyk writes: *These experiences largely depend on the integrity of the work, as well as the context in which the work is presented* [2]. This value is essentially influenced by the relationship between the monument and its surroundings, understood as picturesque.

The church in Karb is an integral building, dominating the landscape of the district. It is situated on the main street of this part of Bytom, on a rectangular-shaped square, partly paved and partly grassy, with high and low-growing vegetation, surrounded by a brick fence. The picturesqueness of its body is created primarily by the neo-Gothic style, emphasized by rosettes, portals and simplified traceries. It is emphasised, especially from the east, by two lofty, slender towers. It is enhanced by a tall ridge at the intersection of the nave and transept and a sloping roof. From the west, the body of the three-sided chancel with adjoining polygonal chapels.

The assessment of the aesthetic value is negatively affected by the aforementioned poor condition of the building, numerous traces of previous renovation and restoration works, unskillfully selected colors of brick fillings on the facades or the recently used protective nets. The aesthetic reception of the building also considerably diminishes the context of its surroundings, which is created by mostly neglected multi-family buildings, especially multi-story apartment blocks.



Fig. 8. Bytom-Karb. Church of Good Shepherd. Temple surroundings. View from the south-east.  
Source: own photo

## Value in use

The last value specified by Walter Frodl is value in use. Janusz Krawczyk in the updated systematics of the values of the Viennese conservator emphasizes that it *should be considered both in relation to the historical and present function, as well as the designed function*. The author also specifies that when assessing this value, it is also important to consider whether the building complies with modern standards, especially if it has retained its original function [2].

The monument in question was in constantly used throughout its over centennial history, serving as a place of worship and individual prayer, and thus integrating the local community of Karb inhabitants. Thus, it continuously performed a sacred function, and generally speaking, a social one, as an object of public utility. The invariability of the primary function essentially raises the assessment of its use-value. It is also intensified by adaptation to modern standards, both in the liturgical dimension, as a Roman Catholic parish church, and as a public utility building. All this makes the value in use one of the leading values in the historical value analysis of the Karb church. As a result, it should be exposed and supported.

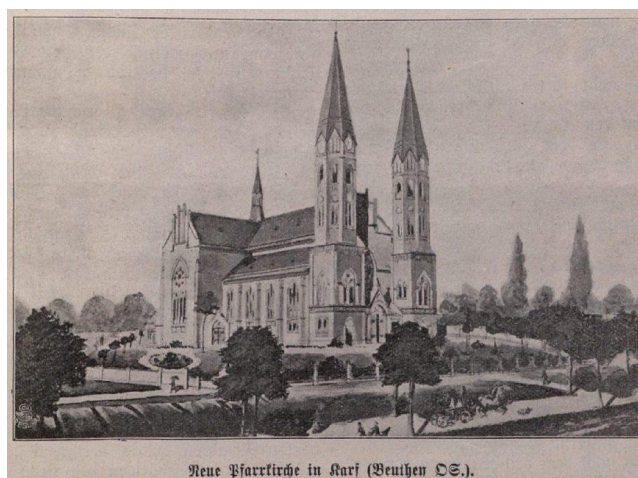


Fig. 9. Bytom-Karb. Church of Good Shepherd. Archival view of the church, third decade of the 20th century.  
Source: Archives of the Good Shepherd Parish in Karbie

## End

The historical value-added analysis allows to highlight the values represented by a given monument, including sacred architecture, which is additionally clearly marked with symbolic meanings. Recognition of the value of a monument should be one of the preparatory stages preceding the taking of specific conservation measures at the valued object. In addition, they are a prerequisite for further, regular conservation care and vigilance so that the given value is not diminished by poorly conducted works or neglect.

The historical value analysis of the church under the invocation of Good Shepherd in Karb in Bytom indicates that this neo-Gothic building, entered in the register of monuments, has values that should have a decisive influence on its further preservation and saving by undertaking extensive renovation and restoration works. Amongst them, the most important are historical values, including historical-scientific and historical-emotional ones, as well as artistic value and, above all, use value, which is reflected in the sacred, public function of this facility, which has remained unchanged for over a century. At the same time, it should be noted that these values need to be furtherly promoted in order to increase the awareness of the people living in the district, so that the desire to maintain the temple and the constant care for their preservation grows in them.

## Literature

- [1] Ustawa z dnia 23 lipca 2003 r. o ochronie zabytków i opiece nad zabytkami, art. 3 ust.1 (Dz.U. 16.04.2021, poz. 710).
- [2] J. Krawczyk, *Dialog z tradycją w konserwatorstwie – koncepcja zabytkoznawczej analizy wartościującej*, „Acta Universitatis Nicolai Copernici”, Zabytkoznawstwo i Konserwatorstwo XLIV, Nauki Humanistyczno-Społeczne, z. 414, Toruń 2013, s. 507-529.
- [3] Riegl, *Nowoczesny kult zabytków. Jego istota i powstanie*, [w:] *Alois Riegl, Georg Dehio i kult zabytków*, red. J. Krawczyk, Warszawa 2002, s. 27-70.
- [4] W. Frodl, *Pojęcia i kryteria wartościowania zabytków, ich oddziaływanie na praktykę konserwatorską*, Warszawa: Ministerstwo Kultury i Sztuki. Zarząd Muzeów i Ochrony Zabytków 1966.
- [5] D. Głazek, *Domus Celeberrima. Architektura sakralna (katolicka) przemysłowej części Górnego Śląska 1870-1914*, Katowice: Akademia Sztuk Pięknych. Śląskie Centrum Dziedzictwa Kulturowego 2003.
- [6] Kozień, *Autentyczność i integralność zabytków w świetle źródeł prawa powszechnie obowiązującego w Polsce*, „Zeszyty Naukowe Towarzystwa Doktorantów UJ”, Nauki Społeczne, nr 21 (2/2018), s. 188-210.

# **ARCHITECTURAL STYLE TRENDS IN THE 19TH AND THE BEGINNING OF THE 20 CENTURY WITH PARTICULAR ATTENTION TO THE SACRED CATHOLIC ARCHITECTURE OF UPPER SILESIA**

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## **Abstract:**

The nineteenth century and the beginning of the twentieth century was a period in which religious architecture flourished. This tendency was particularly evident in the dynamically developing, industrial areas of Upper Silesia, where several dozen neostyle churches were built. The aim of the article is to present the stylistic trends of Roman Catholic parish churches built in the indicated time period. First, the foundations of the applied style diversity will be presented, with particular emphasis on historicism and the development of the neo-Gothic within it. Then, examples of neo-style realizations will be given, mainly from the achievements of two architects – Paul Jackisch and Ludwig Schneider. This will be done on the basis of the analysis and synthesis of information contained in the literature on the subject, as well as the author's own research and observations.

## **Keywords:**

*sacred architecture, historicism, neo-Gothic, Upper Silesia, style trends*

## **Admission**

The history of architecture, including sacred buildings, is characterised by many stylistic transformations that resulted from various factors. They resulted, inter alia, from the artistic search of the creators, changing aesthetic needs of the audience and sometimes they were the outcome of a technical progress. However, as Cezary Wąs writes, styles change. Evolution and modifications in the field of broadly understood art are always determined by two important human inclinations. The first one seeks to base the norms structuring reality on unchanging elements, and is therefore the need for constancy. The second one rests on constantly adjusting to new circumstances by searching for solutions that have not been used so far or transforming the already known ones, therefore it is openness to changes. It is these two features - the need for constancy and the need for change - that have constantly clashed with each other in the course of history, contributing to stylistic changes. However, as Wąs notes, the dominant ones were tradition, proven formulas and existing patterns.

Invention and the drive for change were mainly the factors that improved the well-known. Only the modern times, especially the nineteenth century, entailed a reversal of this tendency [1]. This does not mean, however, that there was a revolution in the art of that time and the creation of a completely new style, or rather a creative use of known patterns, leading to a specific distinctiveness.

## **The concept of style**

In terms of art, style means a classification of artistic phenomena made by *combining works of art with a common quality of forms into groups* [2]. Thus, it is a set of formal features thanks to which it is possible to assign a given canon to a specific epoch, cultural trend or creator. Importantly, a style most often refers to all cultural background occurring at a given time, encompassing various fields of art, as well as marking everyday objects and fashion.

When periodizing the history of architecture, it is possible to indicate several major stylistic periods, which usually do not have sharp boundaries, but on the contrary mostly overlap, draw from each other, often using what has already been accustomed. Bearing in mind this observation, it is easier to understand the circumstances of the dominance of a given style at a given time and to indicate its genesis. It is no different with the sacred architecture that is the subject of this article.

## **Historicism in architecture**

In order to define and understand the style trends of the Catholic sacred architecture of the 19th and early 20th centuries, firstly, it is necessary to indicate their origin in order to embed them in the wide spectrum of architectural works. The indicated time period was related to the centuries-long domination of historicism in architecture, including sacred architecture [3]. Conscious reference to the past had its purpose as well with multifaceted motivation and ideological foundation.

*The Terminological Dictionary of Fine Arts*, defining the term "historicism", generally states that it is a conscious reference to historical phenomena, to the past, thus to what used to be. Then it specifies that understood more broadly in the field of architecture, it is a tendency to use old styles from historical periods. This procedure may include the entire legacy of a given style or use its individual elements. In addition, it is accompanied with scientific studies on the resource of forms and the development of architecture of a given period [4]. The definition also stipulates that the term can also be used in a more narrow sense, referring to the care of faithfulness in the presented elements, their compliance with literary sources, costumology or preserved artifacts used in historical painting. It is also worth noting that the concept of historicism was not formulated until the 1930s. Historicism – generally speaking – is placed between neoclassicism and secession [5]. On its wave, neo-Romanism, neo-Gothic, neo-Renaissance and neo-Baroque developed, each of which referred to its original [6]. Zdzisława Tołłoczko in her extensive monograph *Main trends of historicism and eclecticism in the art of the nineteenth century*, making a precise explanation of the term historicism, analyzes several definitions contained in various dictionaries and encyclopedias [7]. Among other things, the researcher draws attention to the explanation of this entry included in the *New Universal Encyclopedia by PWN*, where it is noted that the essence of this trend in art developing in the 19th and early 20th centuries *was an eclectic imitation of the great styles of bygone eras* [8]. Later the



definition states that this was done in two ways. The first was the imitation of one specific style, which resulted in the aforementioned neo-Romanism, neo-Gothic, neo-Renaissance and neo-Baroque. The second is free and selective combination of forms and decorative motifs derived from various styles [8]. The author of the monograph considers such approach to be an example of *an axiological denomination of historicism*. She points out that although historicism in general by its nature was constructed on imitation, it cannot be reduced only to eclecticism - that is, combining elements of different historical styles in one building – which was used by architects of different times.

She explains that historicism, which flourished in the nineteenth century, did not create replicas of earlier buildings, but using eclectic processing, interpreted the earlier stylistics individually. In this way, the works created in the trend of historicism *were firmly rooted in the past and evoked appropriate associations, which, however, we can easily identify as works from a completely new era* [7]. It manifested itself, inter alia, through an attempt to create ideal patterns, especially in the neo-gothic and neo-renaissance, designed by correcting and perfecting the prototypes. Doing so indicates a deliberate process, not just an imitative repetition. It should be emphasized that both the term "eclecticism" and its meaning in the history of art are constantly discussed, often causing pejorative associations. Hence, today it is used with caution, especially in relation to the architecture of the nineteenth and early twentieth centuries, where, as indicated above, the proper term is historicism, represented by individual neostyle.

It is also worth noting that historicism in the broad sense has been present in architecture since antiquity and has been present in all epochs, often coexisting with new stylistic trends. For the nineteenth century and the beginning of the next century, until the World War I, it was, however, a typical phenomenon, in the strict sense [7]. The words of the eminent Polish art historian, Karol Estreicher (1906-1984), who wrote: *The history of art, however, does not consist of divisions into distinct styles, unlike genres in natural sciences. In the field of art, divisions come from the outside, they are a deduction from phenomena, and sometimes they are half or hypothetical* [9].

## **Neo-Gothic**

The reasons for the development of historicism in the nineteenth and early twentieth centuries, the first and most widely disseminated efflorescence of which was the neo-Gothic, should be sought in eighteenth-century Europe. European societies of that time experienced a multidimensional transformation, affecting both political and economic, religious and philosophical as well as artistic matters, as well as related to technical progress, which was especially visible in the next century [10]. Artistic changes, initiated in the era of the Enlightenment, were associated with an increasing interest in Polish history and related art, especially architecture. The developing fashion for collecting memorabilia of the past, peculiarities, resulted in a love of ruins and admiration for antiquity, which, it should be emphasized, also included the Middle Ages [7]. More or less from the mid-eighteenth century, a multi-threaded discussion about this era began to resonate, conducted not only among a narrow group of experts and theorists of the subject, but also in a wider group of wealthy and educated people. At that time, people began to notice and appreciate the art and culture of the middle ages, previously considered barbaric, and, above all, to reflect on their meaning and influence on the present day. It was connected with the development of research on the Middle Ages, as well as



solidification of art history as a separate scientific discipline [11]. As Zdzisława Tolłoczko writes, *the phenomenon of pre-Romanticism* developing in literature, which characterized the culture of the Enlightenment, had a great influence on the European interest in the Middle Ages [7]. It manifested itself in the literary and artistic *phenomenon of gothic revivalism*, on which basis literary works imbued with mystery and horror, combined with gothic, while the first neo-gothic buildings were created. One of the first to write fantastic gothic tales that contributed to the revival of gothic themes in England was Sir Horace Walpole (1717-1797), Earl of Oxford, art connoisseur and collector, and amateur architect [7]. It is worth noting at this point the view of some researchers of the history of architecture that in Europe, especially in England, Gothic was a style that never completely disappeared [12]. However, its real revival, in the form of countless buildings imitating it stylistically and creatively transforming it, took place in the 19th century [1]. This was announced in the first half of the 18th century by buildings, originally wooden, referring to Gothic forms. Among others, in 1726, the German architect Joseph Effner (1687-1745) built Magdalenenklaus – a Gothic-style pavilion in the gardens of a residence erected for the Bavarian elector. This and similar garden and park buildings opened the way for a return to Gothic forms. However, most of them were erected in a wooden structure, and thus often impermanent. In England, several artists can be considered the precursors of the Gothic Revival. Among them are Sir John Vanbrugh (1664-1726) and Roger Morris (1695-1749) [12]. Undoubtedly, important contributions to the development of Gothic-inspired architecture was made by Sir Horace Walpole (1717-1797) and Robert Adam (1728-1782), an architect and interior decorator, one of the most famous artists of English Classicism. Influenced by Walpole's medieval interests, they rebuilt his own Strawberry Hill Manor in Twickenham in a neo-Gothic style. This implementation, which lasted in the years 1749-1777, is considered to be the beginning of historicism understood as the recreation of old styles, through the creation of neostyles. It should be emphasized, however, that initially they were devoid of the ideological foundation that developed in the 19th century, which will be discussed in more detail below [7]. The Walpole mansion started the vogue for gothic-style country mansions, giving rise to the so-called "baronial style" – "barn style", popular with the English aristocracy. Among others, James Wyatt (1747-1813) [12] wrote there. It should be added that throughout the nineteenth century, the neo-Gothic style, often used in aristocratic residences, was for the contemporaries to emphasize the high prestige of the building, meeting the conditions of "architecture parlante". Over time, this trend has also spread to important public buildings, such as railway stations. And although England was the homeland of the Gothic Revival, it quickly spread to other European countries. Switzerland played a special role in this process, where churches in this style, called "English Churches", began to appear in spa towns.

Further promotion of the "baronial style" was associated with the growing popularity of the above-mentioned literary works set in partly fairy-tale realities of feudal medieval castles, especially horror novels, known as "gothic romances" [7]. Nikolaus Pevsner also indicates the influence of literary works in the formation of neostyles, especially the pioneering neo-Gothic style. The researcher notes that the beginnings of the Gothic Revival and its lush development in the nineteenth century were associated with Romanticism. He recalls the example of the German poet at the turn of the 18th and 19th centuries, Johann Wolfgang von Goethe (1749-1832), who admired the beauty of the Strasbourg Cathedral, paying tribute to the genius of its creators [13]. Romanticism related to the emotional reception of the world, combining elements of nature, human products and

mystical elements, found inspiration in Gothic architecture, especially in its ruins. Wanda Nowakowska, examining this theme, writes: *Romanticism, although "it has many names", ties its origin primarily with the tradition of the Middle Ages, and its lights and shadows acquire a new shape, conjured up with the pen of poets and the brush of artists* [14]. It is also significant that the development of historicism was also the strike on the centuries-old hierarchy of values, carried out by the events of the Great French Revolution. For many people, it caused a need to return to universal, permanent values. The moral revival of individual societies was to be achieved, among other, by art that was truly Christian, ie Gothic [1]. The neo-Gothic style, initiated in England, quickly became an opportunity to recall the vision of the Middle Ages, which effectively implemented the most important ideals of Christian society, and thus gave a sense of stability and order. This opinion was shared by the German romantics [1]. Also Augustus W. Pugin (1812-1852), an English architect, creator of the Palace of Westminster, and others, such as Wiktor Hugo (1802-1885) or August Reichensperger (1808-1895), argued that the essence of the Christian faith can be found in the Gothic style [1]. Thus, the return to it, as Pugin considered, was a moral duty [13]. This architect designed hundreds neo-Gothic churches, dozens of which were built. In his projects, he did not use simple imitations of medieval churches, but rationalized and modernized them. He was of the opinion that Gothic architecture had its sense not only in terms of the structure itself or the function it performed, but also it was ideologically deliberate. He was an advocate of depriving neo-Gothic architecture of any features that were not necessary to fulfill its purpose. Hence, he avoided exaggerated decorativeness, and in the sharp curve and vertical lines used he saw a reference to the posture of the believer's body, who, while standing, fully worshiped God. As a convert in an Anglican country, he popularized the architecture of churches that differed significantly from simple Protestant forms. The designs of his temples were to testify to God's power through haughtiness [1]. The author, continuing the above thought, also notes that in the nineteenth century most architects who designed Catholic churches were people of deep faith. Certainly it was visible in their projects. This situation changed dramatically at the turn of the century, when secularism became a new religion and Catholics began to constitute a definite minority among architects. Similarly to Pugin, architects on the continent began to treat the neo-Gothic style. Its recognition and growing popularity were related to the conviction that Gothic represents the symbolism of the victory of spirit over matter, and is the "dematerialisation" of architecture. In this way, through its verticalism, combined with the striving for the spiritual sublime of man, as well as purity, idealism and power of expression, the Gothic style was considered to be created for sacred architecture [15]. The German philosopher Georg Hegel (1770-1831) wrote at the beginning of the 19th century that Gothic churches were an expression of the Christian spirit, and through a multitude of vertical lines they expressed a longing for God and infinity [16]. The return to the gothic stylist thus became an opportunity for those who created the sacred architecture of the discussed period to express the essence of Christianity, and above all, to demonstrate fidelity to Western culture, and for Catholics also to papal Rome [16].

There are two main periods in the history of the Gothic Revival. The first one, lasting until around 1840, is called decorative or pre-archaeological. Based on the emotional premises and aesthetic feelings, through the decoration itself, it referred to its prototype, evoking ideological associations. Although a sharp arch was used, the frame and rib structure, which was one of the determinants of Gothic architecture, was not used. The second period is the structural neo-Gothic period, which is

a contradiction of the first. It developed from 1840 to the beginning of the 20th century. At that time, first of all, Gothic construction solutions were used, and the interpretation of patterns became more correct and more creative [12]. This is what allowed mainly the change from the decorative to the structural approach [17].

One of the representatives of this variety was Eugène Emmanuel Viollet-le-Duc (1814-1878), a French researcher and conservator, a supporter of stylish purity, even to the point of idealism not present in the originals. It should also be noted that throughout the nineteenth century, a significant role was also played by the Vitruvian triad of *firmitas, utilitas, venustas* – *usefulness, durability and beauty*, supplemented by the principle of appropriateness, i.e. *decorum*. As a result, as noted by Cezary Wąs, architecture became a talking art that could play a significant role in ideological disputes [1]. Adam Maria Szymiski, developing this idea, even writes that the architecture of the late nineteenth century *is identified not so much with the utility program or spatial organization, but with national nationalism and chauvinism* [18].

The nineteenth century is a period of rapid technical progress, industrial development, and entry into modernity. As noted by Zdzisława Tołłoczko, *the Neo-Gothic thus concentrated all those longings, ideals, dilemmas and dreams of a society on the brink of modernity* [7]. Especially in the German-speaking countries after the Congress of Vienna and the subsequent reshuffling of the political influences of Prussia and Austria, the question of what is really "German" has become important? The broad discussion also concerned art, building and expressing national identity and tradition. It was discussed what architecture should look like, what about painting, so that not only would they become a help in solving national problems, but also serve the present day, reflecting its spirit and strengthening this spirit [19]. Already in the 1820s, the German architect Heinrich Hübsch (1795-1863) asked the question – *In welchem Style sollen Wir bauen? (In what style should we build?)*. In this way, he expressed not only the criticism of the still popular neoclassical forms, imitating the antiquity, but above all emphasized the need to define a new style that would express the specificity of its time. In this way, he initiated a discussion in which the problem was not only whether it is possible to create a new style, but also which old styles best meet the needs of the present day. During it, the conviction that the creation of a new style is a matter of long-term evolution has prevailed, but it is possible and justified to use and combine various elements of old styles in order to achieve something new in this way. The divagations on this subject lasted until the beginning of the 20th century [11]. Initially, until the mid-nineteenth century, architects tried many conventions. In this way, neoclassical, neo-Romanesque and neo-Gothic buildings were created. The circular-arch style - "Rundbogenstil" - also known as arcaded, and initiated by the German architect Karl Friedrich Schinkel (1781-1841), is especially worth noting. Undoubtedly, however, as early as the mid-nineteenth century, the neo-Gothic took the lead, especially in sacred architecture [19]. Choosing it was also associated with the conviction, especially in Prussia, that it was a continuation of the native tradition, significant architectural works of the Middle Ages and coincided with the decision to complete the construction of the cathedral in Cologne, taken by Frederick William IV (1795-1861) in 1842 [20]. Numerous objects built in the neostyle convention for many localities, both of medieval origin and those dynamically developing in terms of urban planning, either confirmed their ancient origins or created a historical landscape [7]. In addition, in the Polish territories under partitions, the period from the 1880s until the First World War is associated with the neo-Gothic process of

searching for the "national style". It resulted in, among other things, the idea of the "Vistula-Baltic style", supported by Polish architects of that time, such as Józef Pius Dziekoński (1844-1927) and Konstanty Wojciechowski (1841-1910), and the "Vistula style", promoted especially in Lesser Poland. The most representative example of this variety is the church of St. Josef in Krakow's Podgórze, built according to the design of Jan Sas Zubrzycki (1860-1936) [21].

### **The dominance of historicism in the sacred architecture of Upper Silesia in the nineteenth century and at the beginning of the twentieth century**

The nineteenth century and the beginning of the twentieth century was a period of mass construction of religious architecture [11]. Dorota Głazek reports that between 1850 and 1920, nearly 200 Catholic churches were built in Upper Silesia itself [22]. One of the reasons for this state of affairs, apart from the reconstruction and changes in the historical landscape of large European cities, was the progressive urbanization, also associated with the emergence of new towns and workers' housing estates, which is particularly visible in Upper Silesia. Their inhabitants, workers from nearby mines, steel mills and industrial plants, were provided with basic needs, including spiritual ones. It is also worth noting that sometimes the inhabitants of newly created settlements, especially Catholics, forced the authorities to obtain a permit to build a temple [20]. In the often not very diversified landscape of these estates, the body of the newly built churches was distinguished by its splendor, however, what should be emphasized, most of them are quite similar and only a closer look shows the differences. In Upper Silesia, the wave of neo-style religious architecture began relatively late, only at the end of the third decade of the nineteenth century. This fact was related to the religious policy of the Prussian state known as "Kulturkampf" [23]. With its cessation, in this heavily industrialized area, there was a lively process of erecting numerous neo-style Catholic churches. Importantly, they were not erected within the street frontage, but were planned as free-standing, usually surrounded by low-rise housing estates for workers. They were located in developing areas, often on the outskirts of expanding workers' colonies, so nowadays they are often not located in the center of a given urban area. Their location was often determined by the patron, founder - the state, industrial owner or company - who also influenced the choice of the style of the building [20]. It is important that parishes with the state treasury as their patrons could hire their own architect or use the help of the Ministry of Public Works in Berlin, which had a design office with which many famous designers were associated. Also, from the archbishop's curia in Wrocław, consent to implement a given architectural concept had to be obtained. There was also an architect who could order a specific church design [11].

In the industrial area of Upper Silesia, until the beginning of the 1870s, Catholic sacred architecture was created in two main styles - neo-Romanesque and neo-Gothic. Initially, neo-Romanesque churches were built in the round-arched style, and from the middle of the century, the popularity of neo-Gothic designs was growing. Realizations, especially of the Berlin architectural environment, which were almost entirely deprived of decorations, were referred to as "Spitzbogenstil" [24]. Their greatest popularity fell in the 1870s and 1880s [11]. From the 1880s to around 1905, the neo-gothic trend continued in various forms, as well as the search for new solutions. Projects combining Romanesque and Gothic elements were also implemented [11]. The years 1905-1914 are

the time of the disappearance of neo-gothic forms, and the emergence of neo-baroque churches and churches combining baroque, neo-roman and modernist features. There was also a return to purely Romanesque forms [11]. The emergence of neo-baroque architecture, not only in Upper Silesia, but throughout Europe, was associated with the rediscovery of the advantages of architecture of that time, which so far was considered degenerate by many Gothic eulogists. It was also started to emphasize its familiarity by referring to its "usucapion" in the local landscape [11].

## **Examples of the realization of neo-style churches in Upper Silesia in the discussed period**

The principles of "Kulturkampf" introduced by the Prussian authorities in 1871 led to a strong collapse in the field of sacred architecture. After these practices were discontinued, the prevailing neo-style trends returned in new, numerous projects. However, it should be noted that from the 1880s onwards, the influences of the Cologne Neo-Gothic style, characterized by decorativeness, were clearly fading away. Designers tended rather towards nibbled, block-like blocks, and above all facades devoid of any significant detail. These principles, used in the projects to a greater or lesser extent, began to be combined with borrowings from Protestant sacred architecture, resulting from the discussion on the model temple conducted in the Evangelical Church.

In the fourth quarter of the nineteenth century, the tendency to centralize the church interior was visible, which favored a more complete union of the liturgy with its participants. It was a response to the postulates of clergy and laity that the sacred interiors should be unified, so that the altar was visible to all gathered, and the preacher's voice was heard equally well throughout the space. This approach resulted in projects in which the combination of space at the intersection of the transept and aisles was emphasized. Additionally, the pillars were slender, and the aisles became narrower [11]. The first construction meeting criteria mentioned above was the church of Saints Peter and Paul in Gliwice, currently the cathedral church of the diocese of Gliwice, designed by Hugo Heer (1814-1895) [11]. This Bytom-born construction counselor and Viennese lecturer used sketches for the church in Bogucice, which had been previously prepared and rejected due to their monumentality, when erecting the church in Gliwice [11]. The design of the church in Gliwice was developed in 1890, and its construction lasted in the years 1896-1899. As a result, a neo-Gothic, three-nave basilica with a Latin cross plan was created, with a transept with polygonal closed arms. The whole was completed by a lofty tower in the west elevation. The arrangement of vaulted ribs was used in order to unify the space created at the intersection of the naves and the transept. As Irma Kozina emphasizes, the use of wide window shapes and the support of inter-nave arcades on light pillars causes a feeling of transparency and harmony in the church interior. These are the characteristics of the so-called transitional style (*Übergangsstil*), in which Gothic and Romanesque elements were synthesized [20]. At the end of the eighteenth decade of the nineteenth century, Upper Silesia was primarily designed by local architects, which is an extremely important observation. They themselves made the construction cost estimate and developed plans, which they submitted for approval to investors of the emerging temple. It should be emphasized that in their projects they used both the templates that were popular at the time, which made them part of the pan-European trend, and drew inspiration from local, often nearby, sacred buildings [20]. In this way, a significant, architecturally prolific local creative



environment was created. In this group, two significant figures came to the fore – Paul Jackisch (1825-1912) and Ludwig Schneider (1855-1943).

Born in Opole and died in Bytom, Jackisch designed several Catholic churches, incl. in Dąbrówka Wielka (1882), Siemianowice Śląskie (1884), Lubomia (1886), Bytom (1886), Ornontowice (1893), Mikulczyce (1894), and in Wieszowa (1896). These churches represent various spatial arrangements, from small hall churches to monumental, three-nave basilicas. They are dominated by the neo-Gothic style [20]. Jackisch's designs have several characteristics, such as smooth surfaces of brick walls, sparingly decorated with glazed bricks and fittings, stone detail of portals and window frames, clear additivity of the church body, emphasized by the edges of each of its elements. There is also a noticeable tendency to contrast the vertical lines of the tower and the horizontal lines of the roof ridge [11]. He designed, among others, the church of Holy Trinity in Bytom. It was the first religious project in the region, established after the anti-Catholic laws had ceased to exist. The construction of the church lasted in 1883-1886 [11]. Jackisch used a whole range of Neo-Gothic architectural forms, still modeled on the Cologne tradition. The shape of this church is complicated and rich in decorations. This temple can be considered as a syncretic version of the church of St. Maurice in Cologne [20]. Referring to Jackisch's work, Irma Kozin points out that the motif of the four-sided tower base, often used by this artist, transforming into an octagonal top in the higher parts, could have been borrowed from the work of the Wrocław architect Alexsis Langer (1825-1894), mainly in the neo-Gothic style [20].

Ludwig Schneider, the second of the aforementioned architects, is one of the most significant designers of Catholic sacred architecture in Silesia in the period in question and, what is equally important, he has the largest number of projects on its site [11]. In his work, using professional knowledge, he freely used various style conventions [23]. His designs are also distinguished by the variety of projections and the multitude of shapes of the towers and their helmets. Dorota Głazek points out that Schneider in his subsequent sacred projects often used solutions that had already been applied before, he was inspired by the works of other architects, thus creating various designs [23]. Until the beginning of World War I, Schneider designed at least several dozen buildings – churches, chapels, presbyteries - scattered in the eastern part of the Opole Region and throughout Silesia. He also ran an architectural office, which was based first in Katowice, then in Gliwice, Opole and Wrocław, where he settled around 1907.

A common feature of Schneider's numerous sacred designs, scattered throughout Upper Silesia and beyond, are towers and variously shaped helmets crowning them. The towers, in the architect's opinion, were supposed to be signposts showing the faithful the way to the holy place [20]. Schneider preferred the concept of a single-tower church, but he also designed two-tower churches, an example of which is the church of Holy Trinity in Ruda Śląska - Kochłowice, or the monumental temple of St. Antoni in Rybnik. In the works of this architect, there is also a motif of a wreath of chapels at the presbytery. It occurred in two versions - either around the entire chancel or in a more modest version, reduced to a chapel and sacristy. In the interiors of churches, he strove to unify the interior. It was served by a hall section and a decoration in the form of a brick cladding. A similar solution was also used by the above-mentioned Jackisch [11].

Among the approximately 25 neo-style churches designed by Ludwig Schneider in the industrial area of Upper Silesia, several were built in the neo-Gothic style - these are the churches:



Our Lady of the Scapular in Brzeźce (design from 1903, construction in 1907-1909), under the name of Assumption of the Blessed Virgin Mary in Chorzów Batory (design from 1898, construction in 1898-1901), under the name of Nativity of the Blessed Virgin Mary in Gliwice-Bojków (design from 1898, construction in 1898-1904), under St. Józefa in Katowice-Załęże (design from 1898, construction in the years 1898-1900), under the name of All Saints in Mysłowice-Dzieńkowice (design from 1887, construction in 1887-1888), under St. Of the Apostles Peter and Paul in Piekary Śląskie-Brzozowice Kamień (design from 1889, construction in the years 1898-1899), under the name of St. Anton in Rybnik (design from 1903, construction in the years 1903-1907), under the name of St. George in Rydułtowy (design from 1894, construction in 1895-1896) [11]. All these temples are three-nave, and their projection is dominated by a wide nave and clearly narrower aisles. They have a wide and relatively shallow transept, closed with a straight wall. They show a tendency to unify the space at the intersection of the naves and the transept, as well as the impression of single-space and slender inter-nave supports. They all have a rectangular, polygonal closed chancel with sacristy annexes flanking them, and additionally some of them have a wreath of chapels. All the aforementioned temples have a musical gallery on the facade side, and their interiors are brightly lit thanks to high, pointed windows.

## **End**

The historicizing architecture of the nineteenth and early twentieth centuries, including Catholic churches, consciously referred to the past. However, its aim was not only to imitate, but above all to draw on it creatively. In church construction, almost exclusively brick objects were created, sparingly decorated with stone and ceramic details - profiled and glazed bricks. At the beginning of the 20th century, also with stone facades using natural or artificial stone, often combined with plaster and brick. Stylistic trends depended on the time in which a given church was built, on the preferences of the founder and architect. Neo-Romanesque temples present several main concepts. Classic basilicas with a two-tower façade, a transept, a crypt and an ambulatory around the presbytery were built. Basilica churches with one tower on the axis of the body. Also single-nave and single-tower designs [11]. The numerous neo-Gothic churches are mostly based on a common scheme, modified for individual needs. They are quite modest, with an elongated nave, a transept, a short chancel closed polygonally, with the height of the nave or slightly lower. Most often they have a basilica or hall layout. They usually differ in the form of a tower, a few are two-tower ones [23]. The neo-baroque churches, which were built the least, show the most modernist features, which, however, are also present in the individual realizations of the two above-mentioned neostyles. Undoubtedly, the last church projects, realized just before the outbreak of First World War, became works in which the *mimeticism of historical styles turned into their creative adaptation* [21]. The churches that were built at that time, despite the passage of time and frequent damage they experienced as a result of the progressive industrialization, are a testimony to the urban and cultural development that took place throughout the nineteenth and early twentieth centuries, both in Upper Silesia and throughout Europe [25].

## Literature

- [1] C. Wąs, *Antynomie współczesnej architektury sakralnej*, Wrocław: Muzeum Architektury we Wrocławiu 2008.
- [2] *Styl*, w: Encyklopedia powszechna PWN, 2006, <https://encyklopedia.pwn.pl/szukaj/styl.html>, 25.06.2021.
- [3] Kozina, *Aspekty stosowania pojęcia „historyzm” w badaniach nad architekturą niemiecką XIX wieku*, „Rocznik Historii Sztuki”, t. XXIII, 1997, s. 142-170.
- [4] *Historyzm*, w: *Słownik Terminologiczny Sztuk Pięknych*, red. K. Kubalska-Sulkiewicz, M. Bielska-Łach, A. Manteuffel-Szarota, Toruń: Wydawnictwo Naukowe PWN 2015, s. 152.
- [5] W. Koch, *Style w architekturze. Arcydziała budownictwa europejskiego od antyku po czasy współczesne*, Warszawa: Świat Książki 1996.
- [6] W. Baraniewski, *Historyzm w architekturze XIX wieku*, [w:] *Sztuka Świata*, t. 8, red. A. Lewicka-Morawska, Warszawa: Wydawnictwo Arkady 1994, s. 163-181.
- [7] Z. Tołłoczko, *Główne nurty historyzmu i eklektyzmu w sztuce XIX wieku. Tom I – Architektura. Podręcznik dla studentów wyższych szkół technicznych*, Kraków: Politechnika Krakowska 2005.
- [8] *Historyzm*, [w:] *Nowa encyklopedia powszechna PWN*, t. 2, Warszawa: Wydawnictwo Naukowe PWN 1995.
- [9] K. Estreicher, *Historia sztuki w zarysie*, Warszawa-Kraków: Wydawnictwo Naukowe PWN 1977.
- [10] J. Rabiej, *Tradycja i nowoczesność w architekturze kościołów katolickich. Świątynia fenomenem kulturowym*, „Zeszyty Naukowe Politechniki Śląskiej”, nr 1606, Gliwice: Wydawnictwo Politechniki Śląskiej 2004.
- [11] D. Głazek, *Domus Celeberrima. Architektura sakralna (katolicka) przemysłowej części Górnego Śląska 1870-1914*, Katowice: Akademia Sztuk Pięknych w Katowicach, Śląskie Centrum Dziedzictwa Kulturowego w Katowicach 2003.
- [12] W. Mischke, *Gotyk między trwaniem i odnową*, [w:] „Miscellanea Łódzkie”, *Materiały Ogólnopolskiej Sesji Naukowej Łódzkiego Oddziału Stowarzyszenia Historyków Sztuki i Zakładu Historii Sztuki Uniwersytetu Łódzkiego Neogoty w Muzeum Historii Miasta Łodzi w dniach 12-13 grudnia 1996 roku*, r. 1996, t.1, z. 15, s. 16-20.
- [13] N. Pevsner, *Historia architektury europejskiej*, Warszawa: Wydawnictwo Arkady 1976.
- [14] W. Nowakowska, *Wizje malarskie gotyku w ujęciach romantycznych. Impresje romantyczne*, [w:] „Miscellanea Łódzkie”, *Materiały Ogólnopolskiej Sesji Naukowej Łódzkiego Oddziału Stowarzyszenia Historyków Sztuki i Zakładu Historii Sztuki Uniwersytetu Łódzkiego Neogoty w Muzeum Historii Miasta Łodzi w dniach 12-13 grudnia 1996 roku*, 1996, t.1, z. 15, s. 13-15.
- [15] M. Gała-Walczowska, *Wątki znaczeniowe i symbolika architektury XIX wieku*, [w:] „Kwartalnik Architektury i Urbanistyki”, 2017, t. 62, z. 4, s. 55-82.
- [16] W. Bałus, *Gotyk bez Boga? W kręgu znaczeń symbolicznych architektury sakralnej XIX wieku*, Toruń: Wydawnictwo Naukowe Uniwersytetu Mikołaja Kopernika 2011.
- [17] Miłobędzki, *Zarys dziejów architektury w Polsce*, Warszawa: Wiedza Powszechna 1968.
- [18] M. Szymiski, *Kanon formy architektonicznej w kościele katolickim. Tradycja i współczesność architektury sakrum*, Prace Naukowe Politechniki Szczecińskiej nr 496, Instytut Architektury i Planowania Przestrzennego nr 36, Szczecin: Wydawnictwo Uczelniane Politechniki

Szczecińskiej 2000.

- [19] D. Głazek, *Neogotycka architektura sakralna w Katowicach*, [w:] *Wkład kościołów i zakonu franciszkańskiego w kulturę Katowic*, red. A. Barciak, Katowice 2003, 169-181.
- [20] Kozina, *Architektura sakralna. Neogotycki uniformizm i nowe doświadczenie przestrzenne*, [w:] *Sztuka Górnego Śląska od średniowiecza do końca XX wieku*, red. E. Chojecka, Katowice: Muzeum Śląskie w Katowicach 2004, s. 225-253.
- [21] T. Chrzanowski, *Czy istnieje neogotyck polski?* [w:] „Miscellanea Łódzkie”, *Materiały Ogólnopolskiej Sesji Naukowej Łódzkiego Oddziału Stowarzyszenia Historyków Sztuki i Zakładu Historii Sztuki Uniwersytetu Łódzkiego Neogotyck w Muzeum Historii Miasta Łodzi w dniach 12-13 grudnia 1996 roku*, 1996, t.1, z. 15, s. 5-12.
- [22] D. Głazek, *Kościół Św. Pawła w Nowym Bytomiu. Z problematyki architektury sakralnej Górnego Śląska przełomu XIX i XX wieku*, [w:] *Studia nad sztuką nowoczesną*, red. J. Malinowski, t. 1: *Architektura XIX i początku XX wieku*, red. T. Grygiel, Wrocław-Warszawa-Kraków: Ossolineum 1991, s. 113-119.
- [23] D. Głazek, *Bryły, rzuty, dekoracje kościołów neostylowych na przykładzie architektury sakralnej na Górnym Śląsku*, [w:] „Miscellanea Łódzkie”, *Materiały Ogólnopolskiej Sesji Naukowej Łódzkiego Oddziału Stowarzyszenia Historyków Sztuki i Zakładu Historii Sztuki Uniwersytetu Łódzkiego Neogotyck w Muzeum Historii Miasta Łodzi w dniach 12-13 grudnia 1996 roku*, 1996, t.1, z. 15, s. 56-60.
- [24] D. Głazek, *Neogotycka architektura sakralna w Katowicach*, [w:] *Wkład kościołów i zakonu franciszkańskiego w kulturę Katowic*, red. A. Barciak, Katowice: Instytut Górnos Śląski 2003, s. 169-181.
- [25] D. Głazek, *Kilka uwag o sztuce sakralnej w diecezji katowickiej*, „Śląskie Studia Historyczno-Teologiczne”, t. XVII (1984), red. W. Myszor, Katowice 1984, s. 179-18.

## FELINE HYPERESTHESIA SYNDROME AND ITS AFFECT ON CATS

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### **Abstract:**

The feline hyperesthesia syndrome (FHS) is known by several names, including rolling skin disease, neurodermatitis, neuritis, psychomotor epilepsy, and pruritic dermatitis of Siamese. As evidenced by these names and by the use of the term syndrome, FHS is not characterized as having a single etiology. In fact, it is often a diagnosis of exclusion. The differential diagnosis for FHS includes diseases related to the fields of dermatology, neurology, and behavior. Some doctors believe that the cause of FHS in cats is complex and may not be focused on a single causative agent. As with most behavior disorders, FHS can be controlled but is not likely to be cured. FHS is a rare syndrome whose exact cause is still unknown. It is hard to diagnose because the symptoms of FHS most often appear as short episodes where the cat licks itself up in seconds to minutes. In this article I would like to take a deeper look at the etiology, symptoms and treatment options of FHS.

### **Keywords:**

*feline hyperesthesia syndrome, behavioral changes, FHS, dopamine, opiates*

### **Introduction**

The skin consists of an outer cellular, avascular layer called the epidermis, and an inner fibrous corium or dermis that rests on a supporting layer of fat and very thin muscle. The epidermis is the body's environmental shield. It is made up of tough keratinized cells that are continuously formed and shed from the surface. In some animals and in some areas of the body, epidermis contains dark brown pigment that screens the body from harmful rays of the sun and gives the cat his distinctive color. The dermis is composed of a network of connective tissue that also contains nerves, blood vessels, hair follicles, and sweat and oil glands [1]. The feline hyperesthesia syndrome (FHS) of cats appears as the episodes of rippling or rolling skin along the lumbar spine. It is known by several names, including rolling skin disease, neurodermatitis, neuritis, psychomotor epilepsy, and pruritic dermatitis of Siamese. The skin on the back and around the tail moves independently of the cat's movements, which is very noticeable and disturbing to the caregiver. If these episodes occur more frequently, other types of behavior or symptoms may also arise that are of concern to owners. This can be excessive licking and chewing of the hair in the area that is subjected to waving. During episodes, cats are sometimes over-agitated: their fur is bristling, they run excitedly, their pupils are dilated and

they can vocalize loudly. In more severe cases, there is drooling and uncontrolled neediness [2]. FHS can occur in cats of any age, but it is commonly seen in cats aged 1 to 5 years. Males and females are equally affected. While all breeds can be affected, Siamese, Burmese, Persian, and Abyssinian cats are more commonly afflicted [3]. It is a relatively new disease that many people are unaware of, it is one of the most mysterious and obscure cat ailments. In my article, I would like to collect information on FSH, diagnosis, treatment and shed a little more light on this disease.

## **Symptoms and signs**

The symptoms of FHS most often appear as short episodes where the cat licks itself up in seconds to minutes. Between these "seizures" the animal behaves normally to suddenly begin to show symptoms characteristic of the disorder. Typically these are rippling or twitching skin (back), jerky tail movements, and repeated biting, licking or pinching of the lower back, pelvic region, hind limbs and tail. Additionally, during a seizure, animals often have dilated pupils, are strongly aroused and behave in a chaotic and unpredictable manner [4]. Furthermore signs like peeing outside of a litterbox, vocalizing during urination may appear. Palpation usually shows no neurological problems or serious abnormalities other than damage to the hair cap, which is compromised by intense point licking. Rather, physical stimulation of the muscles of the back of the body has been reported to irritate some patients and occasionally cause a full symptomatic episode [4]. FHS is a rare syndrome whose exact cause is still unknown. It may develop in association with broader behavioral problems, seizures, or neurotic disorders. Very active and nervous cats are treated as a group of increased risk of this disease. Additionally, the occurrence of FHS may be triggered by persistent environmental stress [2]. Some doctors believe that the cause of FHS in cats is complex and may not be focused on a single causative agent. That's what is making rolling skin disease so hard to treat and diagnose correctly.

## **Diagnosis**

When diagnosing FSH, we pay attention to 4 different factors and based on them, we can classify the diagnosis into: dermatologic (Flea allergy dermatitis, food allergy, atopy, infectious dermatitis), neurologic (Epilepsy, brain tumors, spinal disease (disk disease, neoplasia, infectious myelitis), musculoskeletal (Myositis, myopathy), behavioral (Compulsive disorder, displacement behavior). I divided steps in treatment into obligatory and additional ones. In the first group we include: a physical examination, neurologic examination, complete blood count, serum chemistry profile (especially hepatic and renal function), urinalysis, and spinal radiography. Depending on the results we might schedule more tests: skin scraping, fungal culture, skin and/or muscle biopsy, spinal or cranial imaging (computed tomography or magnetic resonance imaging), electromyography, food trials, and pharmaceutical trials (flea control, corticosteroids, antiseizure medication). An additional disease that excludes FHS, and may have similar symptoms, is a disorder in the forebrain region - the effects are, among others, behavioral disturbances and seizures. To exclude this type of problem, imaging diagnostics, including magnetic resonance imaging, is used to show a possible neurological cause of the disease [2].



## **Pathophysiology**

FHS is commonly considered to be a compulsive disorder resulting in self-injurious behavior. One proposed trigger of FHS is displacement behavior. The environmental factors that trigger compulsive behaviors exert their influence by stimulating the hypothalamus and the limbic system, which in turn activate motor activity through the basal ganglia. Three types of neurotransmitters are reported to be involved: dopamine, opiates and serotonin. Increased dopamine levels can result in increased frequency of compulsive behaviors. Dopamine is a neurotransmitter that is produced in the substantia nigra, ventral tegmental area, and hypothalamus of the brain [4]. DA plays a vital role in reward and movement regulation in the brain. In the reward pathway, the production of DA takes place in the ventral tegmental area (VTA), in nerve cell bodies – as mentioned before. From there, it is released into the nucleus accumbens and prefrontal cortex [5]. Moreover, the neurotransmitter dopamine is implicated in a valuation of prospective effort and reward. However, its role in dynamic effort-reward integration during action, a process central to everyday behaviour, remains unclear. In a placebo-controlled, within-subject, study, we probed the impact of increasing brain dopamine levels (150 mg of levodopa) and blocking dopamine receptors (1.5 mg of haloperidol) in the context of a novel dynamic effort task in healthy human subjects. We show that modulating homeostatic dopamine balance distinctly alters implicit and explicit effort allocation as a function of instantaneous reward. Pharmacologically boosting dopamine enhanced motor vigour, reflected in an implicit increase in effort allocation for high rewards [6]. Studies proved that dopamine transporter (DAT) is a protein involved in the reuptake of dopamine from the synaptic cleft into presynaptic structures. Mice lacking the gene coding for the DAT protein (DAT knock-out mice) show marked changes in dopamine homeostasis, as manifested, inter alia, by elevated levels of extracellular dopamine and significant hyperlocomotion in the new environment. The paper presents a brief behavioral and pharmacological characterization of DAT knock-out mice. Since it is known that DAT is the starting point for the action of psychostimulants, special attention has also been paid to the effects of these agents, especially their rewarding and stimulating effects on locomotor activity. Some of the cited research results indicate the participation of other transporters, in addition to dopamine: serotonin and noradrenaline, in the mechanism of action of psychostimulants. This is evidenced by the data describing the occurrence of rewarding effects (conditional site preference and self-administration) of amphetamine, cocaine and morphine and the increase in dopamine release by these compounds in the septal nucleus accumbens in DAT knockout mice, i.e. in the complete absence of a dopamine transporter. DAT knock-out mice can provide a reliable model of increased dopamine system activity, used to accurately describe the molecular mechanisms associated with persistently elevated levels of extracellular dopamine [7]. One theory is that when animals engage in compulsive behaviors, levels of opiates in the brain are elevated, and the pleasurable effects that opiates promote reinforce the behaviors. Another theory is that opiates initiate stereotypic behavior. This theory is based on the observation that administration of opioids enhances the display of amphetamine-induced stereotypic behaviors, but these behaviors are blocked when narcotic antagonists (such as naloxone) are administered [8]. The endogenous opioid system is one of the most studied innate pain-relieving systems. This system consists of widely scattered neurons that produce three opioids: beta-endorphin, the met- and leu-enkephalins, and the dynorphins. These opioids act as neurotransmitters and



neuromodulators at three major classes of receptors, termed mu, delta, and kappa, and produce analgesia. Like their endogenous counterparts, the opioid drugs, or opiates, act at these same receptors to produce both analgesia and undesirable side effects [9]. Serotonin is produced in the dorsal raphe nucleus, and its influence on the basal ganglia and frontal cortex affects behaviors such as compulsive disorders. Higher levels of serotonin reduce the incidence of compulsive disorders, which is the rationale for the use of selective serotonin reuptake inhibitors (SSRIs) to treat these disorders [2]. What is more serotonin is perhaps best known as a neurotransmitter that modulates neural activity and a wide range of neuropsychological processes, and drugs that target serotonin receptors are used widely in psychiatry and neurology. Serotonin regulates numerous biological processes including cardiovascular function, bowel motility, ejaculatory latency, and bladder control. Additionally, new work suggests that serotonin may regulate some processes, including platelet aggregation, by receptor-independent, transglutaminase-dependent covalent linkage to cellular proteins [10]. Serotonin also enters the bloodstream and interacts with multiple organs, priming the body for energy storage by promoting insulin secretion and de novo lipogenesis in the liver and white adipose tissue, while reducing lipolysis and the metabolic activity of brown and beige adipose tissue. Collectively, peripheral serotonin acts as an endocrine factor to promote the efficient storage of energy by upregulating lipid anabolism [11].

## **Behavior Modification**

As with many behavior problems in companion animals, the treatment of FHS combines behavior modification protocols and the use of psychoactive pharmaceuticals. Behaviorally, the goal is to create a stable and consistent environment for the cat. This can be accomplished in the following ways: institute a regular feeding schedule to provide a more predictable source of food/maintaining consistency in interactions with the cat/when managing dogs with a compulsive disorder, one common recommendation is for the owners to use a command-response-reward technique for all interactions - for example, the owner asks the dog to sit and, after the dog obeys, gives it a treat. The same technique can be used with cats/providing regular play sessions using target-type toys (e.g., feather toys)/anticipating situations that trigger the behavior. When the behavior is likely to occur, redirect the cat's activity to more appropriate behaviors, such as training exercises or play.<sup>3,5/</sup> FHS behaviors should not be punished because punishment will increase the cat's conflict and stress, resulting in a likely increase in the problem behaviors [12]. Domestic cats are exposed to a variety of stressful stimuli, which may have a negative effect on the cats' welfare and trigger a number of behavioural changes. Some of the stressors most commonly encountered by cats include changes in environment, inter-cat conflict, a poor human-cat relationship and the cat's inability to perform highly motivated behaviour patterns. Stress is very likely to reduce feed intake, and stress-related anorexia may contribute to the development of potentially serious medical conditions. Stress also increases the risk of cats showing urine marking and some forms of aggression, including redirected aggression. A number of compulsive disorders such as over-grooming may also develop as a consequence of stressful environments. Some of the main strategies to prevent or reduce stress-related behavioural problems in cats are environmental enrichment, appropriate management techniques to introduce unfamiliar cats to each other and the use of the synthetic analogue of the

feline facial pheromone. As the stress response in cats depends, to a large extent, on the temperament of the animal, breeding and husbandry strategies that contribute to the cat developing a well-balanced temperament are also very useful [13].

## **Pharmaceutical intervention**

Veterinary medicine has not yet developed a dedicated treatment for FHS. Despite this, many medical preparations can soothe seizures. In addition, many cats were found to improve as a result of caregiver-induced environmental changes combined with behavioral therapy [2]. The three main classes of medications used to treat FHS are SSRIs, tricyclic antidepressants (TCAs), and benzodiazepines. When using any of these medications in cats, it is best to begin at the lower end of the dose range, then titrate upward as needed to achieve the desired response. This approach minimizes the potential for serious side effects such as prolonged anorexia or excessive sedation [14]. Once the frequency of the behavior reaches an acceptable level, treatment should be maintained for 4 to 6 months. The dose can then be gradually reduced (25% reduction every 1 to 2 weeks) until the patient has been weaned off the drug. If the behavior recurs or increases in frequency during the weaning process, the previously effective dose should be reinstituted. Another reduction may be attempted after another 4 to 6 months of therapy; however, some patients require lifelong administration of the medication. If the patient is receiving combination therapy (an SSRI or TCA with a benzodiazepine), the medications should be weaned one at a time to determine which drug is responsible if signs return as the dose is reduced [15]. The following dosages are recommended for cats with FHS: Fluoxetine: 0.5 to 2.0 mg/kg PO q24h / Paroxetine: 0.5 to 1.0 mg/kg PO q12–24h. The adverse effects of SSRIs include sedation, anorexia, irritability, vomiting, and diarrhea. In addition, SSRIs inhibit the function of the liver cytochrome P450 enzymes CYP2C9, CYP2D6, CYP2C19, and CYP3A4. As a consequence, care should be taken when prescribing concurrent medications that rely on these enzymes for their metabolism (e.g., phenobarbital, carbamazepine, benzodiazepines, TCAs). SSRIs should not be used in combination with each other or with other drugs that increase serotonin levels, such as monoamine oxidase inhibitors (e.g., selegiline), other SSRIs (e.g., paroxetine, sertraline), or TCAs (e.g., amitriptyline, imipramine, doxepin) [16]. Of the TCAs, clomipramine (0.5 to 1.0 mg/kg PO q24h) can be used to treat FHS. Adverse effects associated with this drug include sedation, anticholinergic effects, potentiation of arrhythmias in predisposed patients, and lowering of the seizure threshold in patients with seizure disorders [17]. These benzodiazepines are recommended in cats because they do not have active metabolites. Diazepam has been implicated in cases of hepatic necrosis in cats. Lorazepam: 0.125 to 0.50 mg PO q8–24h / Oxazepam: 0.20 to 0.50 mg/kg PO q12–24h. The potential adverse effects of these drugs include sedation, ataxia, and temperament changes. Combination therapy with an SSRI or a TCA is acceptable with either of these drugs if no agent alone provides sufficient response [18].

## **Conclusion**

FHS has multiple possible etiologies, it is an unusual and intricate disorder not completely understood yet. It requires patience and close communication with the pet's owner in order to arrive

at the correct diagnosis. As with most behavior disorders, FHS can be controlled but is not likely to be cured. By developing a clear diagnostic plan and following it closely, veterinarians can avoid confusion for the owner and foster a sense of cooperation between the owner and themselves [2]. Cats affected by FHS can be in a consult without evidence of alopecia or other dermatological lesions [16]. If the factor that triggered the cat's FHS cannot be determined, preventive measures often mean that all potentially stressful factors are excluded from the feline environment. Domestic cats are exposed to a variety of stressful stimuli, which may have a negative effect on the cats' welfare and trigger a number of behavioural changes. Some of the stressors most commonly encountered by cats include changes in environment, inter-cat conflict, a poor human-cat relationship and the cat's inability to perform highly motivated behaviour patterns. Stress is very likely to reduce feed intake, and stress-related anorexia may contribute to the development of potentially serious medical conditions. Stress also increases the risk of cats showing urine marking and some forms of aggression, including redirected aggression [19]. In summary, FSH is a disease that is little talked about in the community of cat owners and veterinarians alike. In the articles you can find references to the work on the alleged drug - but this is not certain. To understand the basics of this disease, we must pay close attention to our animals. More and more funds are spent on research to determine the cause of this disease. However, until they are discovered, all we can do is spread awareness among people and exchange the latest knowledge.

## Literature

- [1] *Structure and Function of the Skin and Hair Coat in Cats 2015*,  
<https://www.petplace.com/article/cats/pet-health/structure-and-function-of-the-skin-and-hair-coat-in-cats>, 03.08.201.
- [2] *Kocibehawioryzm.pl – blog autorski 2018*,  
<http://blog.kocibehawioryzm.pl/2018/03/13/syndrom-falujacej-skory-kotow-fhs/?fbclid=IwAR3StcsVCCLjXA1SwnNB1XkSbJG-QxBhPe632Q90AU-8ebxiqZFB--W-1PE>, 13.03.2018.
- [3] D. Horwitz, J. Neilson. Psychogenic alopecia/overgrooming: feline. In Blackwell's Five-Minute Veterinary Consult Clinical Companion, Canine and Feline Behavior. Ames Blackwell Publishing., (2007), Vol. 425-431.
- [4] *Cornell Feline Health Center 2021*,  
<https://www.vet.cornell.edu/departments-centers-and-institutes/cornell-feline-health-center/health-information/feline-health-topics/hyperesthesia-syndrome>
- [5] H. J. Olguín, D. C. Guzmán, E. H. García, G. B. Mejía. The Role of Dopamine and Its Dysfunction as a Consequence of Oxidative Stress., (2016)
- [6] J. Michely, S. Viswanathan, T. U. Hauser, L. Delker, R. J. Dolan, C. Grefkes. The role of dopamine in dynamic effort-reward integration. Neuropsychopharmacology., (2020), Vol. 45, 1448–1453,
- [7] G. Biala. Charakterystyka behawioralna i farmakologiczna myszy pozbawionych genu kodującego transporter dopaminowy. Postepy Hig Med Dosw., (2004), Vol. 58,

- [8] S. Crowell-Davis, T. Murray. Opioids and opioid antagonists. Veterinary Psychopharmacology. Blackwell Publishing., (2006), Vol. 212,
- [9] J. E. Holden, Y. Jeong, J. M. Forrest. The endogenous opioid system and clinical pain management. AACN Clin Issues., (2005), Vol. 16, 291-301
- [10] M. Berger, J. A. Gray, B. L. Roth. The expanded biology of serotonin. Annu Rev Med., (2009), Vol. 60, 355-66,
- [11] J. M. Yabut , J. D. Crane, A. E. Green, D. J. Keating, W. I. Khan, G. R. Steinberg. Emerging Roles for Serotonin in Regulating Metabolism: New Implications for an Ancient Molecule. Endocr Rev., (2019), Vol. 40, 1092-1107,
- [12] *Understanding Behavior — Feline Hyperesthesia Syndrome 2009*,  
<https://www.vetfolio.com/learn/article/understanding-behavior-feline-hyperesthesia-syndrome>, 08.03.2009.
- [13] M. Amat, T. Camps, X. Manteca. Stress in owned cats: behavioural changes and welfare implications. First Published June., (2015),
- [14] S. Crowell-Davis, T. Murray. Selective serotonin reuptake inhibitors. Veterinary Psychopharmacology. Blackwell Publishing., (2006), 80-110.
- [15] D. Horwitz, J. Neilson .Tail chasing and spinning: canine and feline. Blackwell's Five-Minute Veterinary Consult Clinical Companion. Canine and Feline Behavior. Blackwell Publishing., (2007), 475-483,
- [16] *Feline hyperesthesia syndrome 2009*,  
<https://www.VeterinaryPartner.com>.
- [17] S. Crowell-Davis, T. Murray. Tricyclic antidepressants. Veterinary Psychopharmacology. Blackwell Publishing., (2006), 179-206,
- [18] S. Crowell-Davis, T. Murray. Benzodiazepines. Veterinary Psychopharmacology. Blackwell Publishing., (2006), 179-206,
- [19] M. Amat, T. Camps, X. Manteca. Stress in owned cats: behavioural changes and welfare implications. J Feline Med Surg., (2016), Vol. 18, 577-86

## LOVE AND MATHEMATICS

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### **Abstract:**

This article discusses problem of mathematical modeling of love and interpersonal relationships. It shows an overview of what has already been explored by mathematicians and psychologists. The article starts with showing an almost anecdotic use of the famous Drake Equation – can it be used to calculate one's chance of meeting love of their life? Then it proceeds to a very practical use of mathematics – in form of an algorithm on a dating side called OKCupid. Next topic is application of game theory concepts in terms of relationships – we discuss searching for a partner using Gale-Shapley algorithm and „game of fidelity” – a variation of the prisoners dilemma. The next chapter presents discoveries from study done by Swedish mathematicians, concerning the web of human sexual contacts, The last chapter summarises one of the biggest mathematical studies on subject of marriage. This article discusses very interesting applications of mathematics in a form which is suitable both for mathematicians and people with other education.

### **Keywords:**

*mathematical modeling, love, marriage*

### **Introduction**

Love is one of the most commonly discussed aspects of human existence. It is a very important feeling which we cannot fully understand – sometimes it looks almost as magic. However, as everything else in this world, love is full of patterns. Therefore we can at least try to characterize it using mathematical terms. This article is an attempt to present many ways in which mathematicians tried to capture love in numbers and equations.

### **Drake's Equation – chances of meeting your love**

Drake's equation was presented in 1961 by dr Frank Drake. The purpose of this equation is to roughly estimate number of highly developed civilizations which may exist on other planets in our galaxy. The form of this equation is as seen in (1):

$$G = R \cdot f_p \cdot n_e \cdot f_i \cdot f_l \cdot f_e \cdot L, \quad (1)$$

where:

- G – number of civilizations capable of interstellar communication,
- R – rate of formation of stars capable of supporting life,
- $n_e$  – average number of planets similar to Earth, per planetary system,
- $f_1$  – fraction of Earth-like planets which support life of any kind,
- $f_i$  – fraction of life-supporting planets where intelligent life develops,
- $f_c$  – fraction of planets with intelligent life which are capable of interstellar communication,
- L – length of time such communicating civilizations survive.

Using this equation, Drake estimated, that in the Milky Way Galaxy alone, there may be about 10000 planets with civilizations capable of interstellar communication. Considering that there are about 300 billion stars in our galaxy, the probability that a chosen star supports said civilization, equals about 0.0000003%. This chance is very small, but the probability is positive, and this approach is widely accepted by physicists and astronomers.

In 2009 student of economics from Warwick, Peter Backus [1], redefined this equation in a humorous way, so that one could check his chances of meeting love. New parameters of equation are as follows:

- G – number of potential partners,
  - R – population growth in Great Britain: about 150000 yearly,
  - $f_w$  – fraction of UK citizens who are women: 51%,
  - $f_l$  – fraction of women who live in London: 13%,
  - $f_A$  – fraction of women in London who are age-appropriate (Backus, being 31 at the time, chose fraction of women between 24 and 34): 20%,
  - $f_U$  – fraction of age-appropriate women who have university education: 26%,
  - $f_B$  – fraction of university educated women who the author would find physically attractive: 5%,
  - L – age of the author: 31 when he published his article on Drake's equation.
- This results in equation (2):

$$G = R \cdot f_w \cdot f_l \cdot f_A \cdot f_U \cdot f_B \cdot L. \quad (2)$$

The number of people who live in Great Britain has the following relation with population growth rate:

$$N = \int_0^T R(t) dt. \quad (3)$$

Assuming that R is constant in time, we have  $N=RT$ . Such simplification of (3) is often used in Drake's equation. For further simplification, Backus used number of people living in UK in 2007,  $N^*=60975000$ . He included  $N^*$  in equation (2) instead of R. If we substitute the above values to equation (2), we get result  $G=10510$ . So Backus' conclusion was that there are 10510 potential girlfriend for him in UK. This consists of about 0.00017% of all women in UK and 0.0014% of all women in London. It would mean that Backus had about 1/1000 chance of meeting the woman he could fall in love with. However, he noticed that those calculations do not take into account facts such as: how many of those women would find him attractive, how many are single and how many of them



he could get along with. He estimated that about 5% from given 10510 women would find him attractive, half of those are single, and he could get along with 10% of them. This resulted in a much lower number than before – in UK there was a total of 26 women that he could potentially date. This meant he had 0.0000034% chance of meeting an appropriate partner – only 100 times more than a chance of finding highly developed civilization on a randomly chosen planet.

Admittedly, the criteria chosen by Backus seem to be somewhat strict (for example the need of university education). Moreover, Peter Backus met the love of his life just two years after publishing article about Drake's equation (he married her in 2013). Still, using his method and having precise criteria, everyone can estimate the approximate number of their potential partners.

## **Love online and „experiments on human beings”**

Nowadays, online dating is an increasingly popular way to meet potential partners. One of the largest dating sites in the U.S. - OKCupid - is of particular interest to us because it was founded by a group of people with a background primarily in mathematics. OKCupid aims to implement appropriate algorithms in order to best matching of two potential partners.

The algorithm used by OKCupid is actually not very complicated - it mainly consists of addition, multiplication and square rooting. The first and most important step is to convert the information about how well two people match into numerical data. The dating site asks users questions about their interests, future plans, faith, and so on. A simple approach would be to match people who give similar answers, for example, two people who answer affirmatively to the question, "Do you like horror movies?" will probably get along better than a couple in which one person likes scary movies and the other hates them. However, the problem arises with questions such as "Do you like being the center of attention?" Two people who answer affirmatively, could have more problems in their relationship than if only one person in the couple likes to be the center of attention. Therefore, in OKCupid, the user provides both an answer on their own behalf and an answer that they would like to hear from their partner. In addition, some of the questions may say more about a person than others-for example, a question about political preferences may be more important than asking about movie tastes. Therefore, in addition to answering the question, user must also determine how important this question is to them.

The importance of the question determines the maximum number of points that can be obtained by a potential partner for a compliant answer. The numbers of points for each category are as follows:

- irrelevant - 1 point,
- a little important -10 points,
- somewhat important - 50 points,
- very important - 100 points,
- mandatory - 250 points.

So ultimately, input from one person consists of three things:

- her/his responses,
- the answers he/she would like the potential partner to give,
- the validity he/she assigns to the questions.

We will analyze how the algorithm works with a concrete example. For simplicity, we will use an example with only two questions. The first question will be "How messy are you?" with possible answers: "messy", "average", "very organized". Person "A" responds to this question that they are very organized, that they would like their partner to be very organized as well, and that this question is very important to them. Person "B" responds that they are very organized, would like the partner to be tidy on average, and that this question is only a little bit important. The second question is "Do you like to be the center of attention?" where the answer can only be yes or no. Person "A" says no, they would like their partner to say no as well, and the question is a little bit important to them. Person "B" answers affirmatively, would like their partner to say no, and the question is somewhat important. All those answers are presented in Tab. 1.

Tab. 1. Responses from person A and person B

Person A	How messy are you?	Do you like to be the center of attention?
Person A's response	Very organized	No
Expected response from person B	Very organized	No
Importance of the question to person A	Very important	A little important
Person B	How messy are you?	Do you like to be the center of attention?
Person B's response	Very organized	Yes
Expected response from person A	Average	No
Importance of the question to person B	A little important	Somewhat important

Source: own work based on answers from [2]

In the first step, we check how well person "B" matches person "A". Since person "A" rated the first question as "very important", one can get a maximum of 50 points for this question. Person "B" answered to this question as expected, so they get 50 points. Person "B" rated the second question as "somewhat important", so it is worth 1 point. Person "B" answered this question not as expected. Thus person "B" scores  $(50+0)/(50+1)=50/51=98\%$ .

In the second step, we check how well person "A" matches person "B". Person "B" rated the first question as "somewhat important," so it is worth 1 point. Person "A"'s answer is not as expected, so they do not get a point for this question. The second question was somewhat important for person "B", therefore it is worth 10 points. Person "A" answered this question as expected, so they get 10 points. Person "A" thus got a score of  $(0+10)/(1+10)=10/11=91\%$ .

In the third step, we calculate the match percentage of two individuals. It is calculated as the geometric mean of the results of both individuals ( $n^{\text{th}}$  root of the product of scores of both individuals). In our study case we had only two questions, so  $n=2$ , which gives match percentage of  $(91\% \times 98\%)^{1/2}=94\%$ .

It is worth mentioning why the geometric mean is a better solution than the arithmetic mean. The geometric mean works better when we have data with a wide range of values (which is the case here) [2]. Intuitively, this approach also makes more sense. If we used a simple arithmetic mean, then two individuals with match rates of 100% and 0% would be as well matched as individuals with match rates of 50% and 50%, and in practice we can see that it is the latter couple would be more likely to form a happy relationship.

One of the co-founders of the OkCupid website, Christian Rudder, in his article "We Experiment On Human Beings!" [3] talked about the research the OkCupid team conducted to verify the effectiveness of the match percentage calculated by the algorithm. In his opinion, the match percentage is a very good predictor of whether two people can form a relationship. It is correlated with the chance of getting a response to a message, the length of the conversation, the chance of exchanging contact information, etc. The OkCupid team decided to see if two people would strike up a conversation (striking up a conversation is understood here as exchanging at least 4 messages) if they only think they are a good match, but actually have a low match percentage. For this purpose, for pairs with a low match percentage of 30%, a displayed score was 90 %. It turned out that such people were actually more likely to engage in conversation. The results for pairs with a match percentage of 30 % who were displayed 30, 60, or 90 %, respectively, are shown in the table in Fig. 1.

For users whose actual match percentage is 30%... when we DISPLAYED			
	30% match	60% match	90% match
Odds of sending <b>one</b> message:	14.2%	16.5%	16.9%
Given that they sent one message, odds of exchanging <b>four</b> :	9.7%	16.0%	17.4%

Fig. 1. Probability of engaging in conversation for people who saw different match percentages  
Source: [3]

You can see the probability of starting a conversation increase from 14.2% to over 16% when the displayed match percentage was two or three times greater than the actual. However, an even greater difference can be seen in the probability of exchanging at least four messages, which was 9.7 percent for a 30 percent match and increased to 16-17.4 percent when the displayed match percentage was inflated.

The table in Fig. 2 shows the probability of a single message turning into a conversation (at least 4 messages) depending on what the true match percentage was (in rows) and what was displayed (in columns). The table shows that indeed an inflated matching percentage caused this probability to increase, However, for the best matchers (90%), this probability was equally high, even if the value given to the user was an underestimate.

Odds of a single message turning into a conversation				
		number DISPLAYED to them		
		30% match	60% match	90% match
ACTUAL compatibility of users	30% match	10%	16%	17%
	60% match	13%	13%	16%
	90% match	16%	17%	20%

Fig. 2. Odds of single message turning into a conversation for different match percentage  
Source: [3]

The OKCupid team has conducted many similar experiments, using statistics to advise users on how best to use the service. Christian Rudder's articles have included how best to take a picture for a dating site, what messages have the best chance of being responded to by a potential partner, whether a description or a picture is more important, and much more. OKCupid takes great pride in the fact that they were able to use a "one-of-a-kind" mathematical algorithm to connect people based on "what really matters" [4].

## Game theory in love

In this chapter, we will use concepts from game theory to describe relationships between people [5].

### Stable marriage problem

To begin, we consider the following problem: there are 6 single people, including 3 men and 3 women: Joey, Chandler, Ross, Phoebe, Monica, and Rachel. We assume that each of these people has certain preferences as to who they would like to date (these preferences are shown in Tab. 2).

Tab. 2. Preferences as to who to date between six single people

Person	First choice	Second choice	Thrid choice
Ross	Rachel	Phoebe	Monica
Chandler	Rachel	Monica	Phoebe
Joey	Phoebe	Rachel	Monica
Rachel	Joey	Ross	Chandler
Phoebe	Ross	Chandler	Joey
Moncia	Joey	Chandler	Ross

Source: own work based on [5]

Because some characters are the first choice for several people, it is not possible for everyone to date the person they most prefer. To begin, let's assume a scenario where a man approaches a woman. Ross and Chandler both approach Rachel first, and she chooses Ross, because he's higher on her list (but if Joey approached her, she would she would have left Ross out). A rejected Chandler approaches his candidate number two, which is Monica. Since she had no other offers, she makes a date with Chandler. Joey, on the other hand, is the only one who approaches Phoebe and dates with her. We thus received the following couples:

1. Ross-Rachel
2. Chandler-Monica
3. Joey-Phoebe

We have reached a situation where neither gentleman is able to improve their score. They find themselves respectively with their first, second and first choice. The situation for the women is worse: Rachel, Monica and Phoebe are with their second, second and third choices respectively. However, they also cannot improve their score any further: if, for example, Rachel wanted to date Joey now, she would have to face rejection, because he is already with his first choice.

We will now switch roles - have the women approach the men first. This will result in the following pairs:

1. Rachel-Joey
2. Phoebe-Ross
3. Monica-Chandler

Thus, women are respectively with their first, first and second choice. In turn, each of the men found themselves with their second choice.

The above problem is called the "stable marriage problem", and Gale-Shapley algorithm is used for the pairing process. If men approach women first, the following facts take place:

1. Each person finds a partner.
2. Once the pairs are established, no one is able to improve their score.
3. Each man is with the best available partner.
4. Each woman is with the least suitable partner possible.

For the situation in which women approach men, the last two conclusions are the opposite.

From conclusions 3 and 4, we can see that the group that takes the risk and approaches the person in the other group, risking rejection, is able to achieve much better results than a group that passively waits for someone to approach them. This makes intuitive sense: if you start your search for a partner with the best possible, you will end up with the best one who wants you. If you passively wait, you will end up dating the least suitable person who decides to start a conversation with you. So the math confirms that it is worth taking initiative and challenge.

The Gale-Shapley algorithm mentioned above has many practical applications. It has been used, among others, in the United States to recruit doctors in hospitals. In its original version, it was hospitals that "approached" doctors, which resulted in employing doctors who were actually needed in a given hospital. However, such a system resulted in many doctors being dissatisfied, making them worse employees. When this problem came to light, the roles were reversed and from then on, it was the doctors who made offers to the hospitals.

There are many modifications of this problem, assuming ties in lists of preference lists or situations where a person would rather be alone than make an appointment with anyone. The conclusion is always the same: it is better to actively looking for an opportunity rather than passively waiting for someone to approach you.

### Game of fidelity

Consider two people living in a relationship. Both are not too concerned that infidelity is considered wrong, and they just want to end with the best possible "outcome." The different strategies result in the outcomes shown in the table in the figure 3. Such a table is called a "payoff matrix."

		WIFE	
		Fidelity	Infidelity
HUSBAND	Fidelity	+10	-10
	Infidelity	+20	-5

Fig. 3. Payoff matrix in „game of fidelity”  
 Source: own work based on [5]

The best solution for everyone is to remain faithful. In this way both parties get something valuable out of the relationship. This situation is called the Pareto equilibrium.

By remaining faithful, each partner has a score of 10. If one of the partners decides to cheat, he or she has a chance to increase his or her score to 20. For the other partner, this will have a negative effect and they will end up with a score of -10.

On the other hand, if both parties decide to cheat, they both will end up with a score of -5 - much worse than if they had been faithful.

This configuration is equivalent to the so-called "prisoner's dilemma", one of the most widely studied problems in game theory. In the prisoner's dilemma, two people are suspected of the same crime. They are interrogated separately, and each has a choice: give out the other person or say nothing. If both people remain silent, they will share the sentence. If one person betrays, and the other does not, one will go free and the other will get a heavy sentence. If both people betray, both will get a high sentence. The payoff matrix looks the same as in the "game of fidelity". Indicating the criminal while he remains silent is the most advantageous. But the worst situation is to sit quietly while the other suspect reports you.

Unlike the prisoner's dilemma, in a relationship the decision is not made once. In addition, if both individuals are involved, then the joint outcome becomes more important than the individual one. Therefore, in the long run, fidelity is mathematically the most advantageous strategy.

## **Mathematics of physical love**

Mathematics can be used to model many aspects of human relationships, including sexual contacts. Such research is conducted for example to prevent spreading venereal diseases. In 1999, such research was carried out in Sweden [6]. Based on answers given by 2810 respondents, mathematicians concluded that the cumulative distributions of the number of sexual partners during the twelve months prior to the survey decays as a power law with similar exponents  $\alpha \approx 2.4$  for females and males. Generally men declared higher number of sexual partners than women, however the scaling exponents were similar for both sexes. This distribution can be seen on Fig. 4. In a double-logarithmic plot, for both men and women, the data follows closely a straight line. Moreover, the lines are approximately parallel. For women, for  $k > 4$ , the researchers obtained value of exponent  $\alpha = 2.54 \pm 0.2$ , and for men, for  $k > 5$ , they obtained  $\alpha = 2.31 \pm 0.2$ . The web of sexual contacts is an example of a scale-free web, which means that, in contrast to distributions such as Gaussian or exponential, it doesn't have a well-defined parameter such as mean or standard deviation. Scale-free webs are characterized by a power law decay of the cumulative distribution,  $P(k) \sim k^{-\alpha}$ . In case of the web of sexual contacts, the interpretation is that the probability of someone having more than  $k$  partners equals  $k^{-\alpha}$ . Swedish researchers propose a few explanations of such distribution:

1. increased skill in getting new partners as the number of previous partners grows,
2. different levels of attractiveness,
3. the need to have many new partners to maintain self-image.

In this context, they quote a saying „the rich do get richer”.



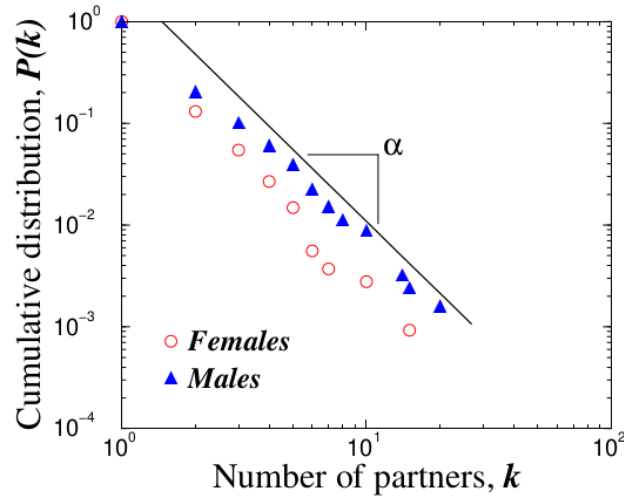


Fig. 4. Distribution of number of partners in only the previous year  
Source: [6]

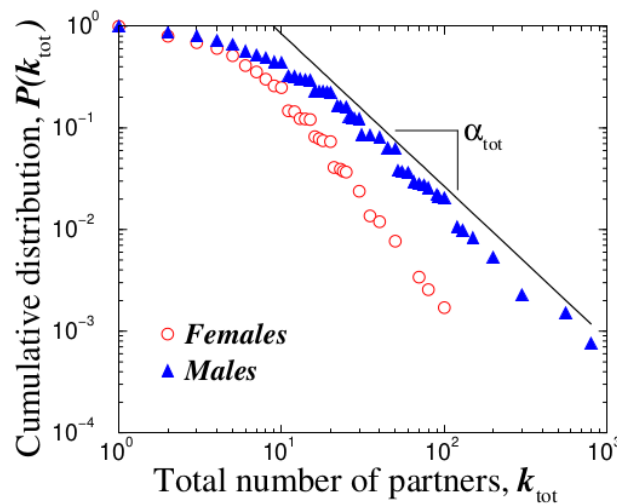


Fig. 5. Distribution of the total number of partners over all years since sexual initiation  
Source: [6]

Fig. 5 depicts the distribution of total number of partners. For women  $\alpha_{\text{tot}} = 2.1 \pm 0.3$  for  $k_{\text{tot}} > 20$ , while for men  $\alpha_{\text{tot}} = 1.6 \pm 0.3$  for  $20 < k_{\text{tot}} < 400$ . Those two estimates are equal within statistical uncertainty.

This research was conducted in the context of the spread of venereal diseases. Hence, the possibility that the web of sexual contacts has a scale-free structure indicates that strategic targeting of safe-sex education campaigns to those individuals with a large number of partners may have a significant effect in reducing the propagation of sexually-transmitted diseases.

## Mathematical „Happy ever after”

One of „the most mathematical” research about love, is a work titled „The Mathematics of Marriage” [7], which presents experiments conducted by a team of mathematicians and psychologists led by John Gottman. Marriage has so many aspects that can be modeled, but Gottman and his team focused on finding a way to determine whether a couple has high probability of divorce. To do so, they chose a special variable, the Gottman-Levenson variable, a sum (or a ratio) of positivity and negativity. They also took into consideration two additional problems: the first is called the relapse effect, which refers to a pervasive finding that initial gains in marital therapy relapse after one to two years, the second is the delay effect - the average amount of time a couple waits to get professional help from the time one of them detects serious problems in the marriage is six years. The researchers were curious whether those phenomena can be minimized and what causes them. They propose that one parameter of their mathematical model of marriage, the negative threshold, can be used to explain both of these effects.

In their study, the team decided to focus on situation created in their laboratory, when a couple engages in discussion of an area of conflict in the marriage. Initially, the variable they used to drive the model consisted of the positive minus negative behaviors at each turn of speech during the conversation, using the Rapid Couples Interaction Scoring System (RCISS). They had found that the slopes of the cumulative point graphs of this variable predicted marital dissolution or stability. They referred to this variable as the Gottman-Levenson variable. Later this variable was replaced by an analogous variable constructed from their Specific Affect Coding System (SPAFF) by assigning positive and negative weights to the individual codes and by summing over a six-second period, which is the average length of a turn of speech. The weights are as follows: disgust, —3; contempt, —4; belligerence, —2; domineering, —1; anger, —1; fear, 0; defensiveness, —2; whining, —1; sadness, —1; stonewalling, —2; neutral, 0.1; interest, +2; validation, +4; affection, +4; humor, +4; and excitement/joy, +4. This weighting yields a potential range of —24 to +24. For each couple, this created two time series, each with 150 data points, one series for the initiator and one for the partner.

Based on data they collected in laboratory studies, the researchers proposed following equations describing partner’s behavior:

$$\begin{aligned} W_{t+1} &= I_{HW}(H_t) + r_1 W_t + a, \\ H_{t+1} &= I_{WH}(W_t) + r_2 H_t + b, \end{aligned} \quad (4)$$

where H and W refer to a measure of positive or negative behavior at time t, t+1, etc. for husband and wife, respectively. Parameters a and b are the initial behavioral state for each spouse (initial uninfluenced behavior with which they enter the interaction), parameters  $r_1$  and  $r_2$  reflect the influence of each person’s immediate past behavior on their own self and are called behavioral inertia (at time t + 1, how likely are they to remain behaviorally the same as at time t?).  $I_{HW}$  is the influence of the husband on the wife when his behavior is  $H_t$ . Conversely,  $I_{WH}$  is the influence of the wife on the husband when her behavior is  $W_t$ .

To describe the influence of one spouse to another, the researchers used ogive functions. They need the following assumptions: behaviors are assumed to have thresholding properties. Positive behaviors have positive influence, and negative behaviors have negative influence, but there

is a limit to the amount of positivity and negativity. Positive/negative behaviors by one spouse below or above a certain threshold ( $T^+$  and  $T_-$  in figure X) have a constant intermediate positive/negative influence on the other spouse. Behaviors by one spouse above the positive threshold and below the negative threshold have a constant large influence on the other spouse. The parameters of these influence functions (e.g., the point at which the spouse's negativity starts having an effect) might vary as a function of the nature of the marriage, the cultures of the spouses, their marital satisfaction, the level of stress the spouses were under at the time, and so on.

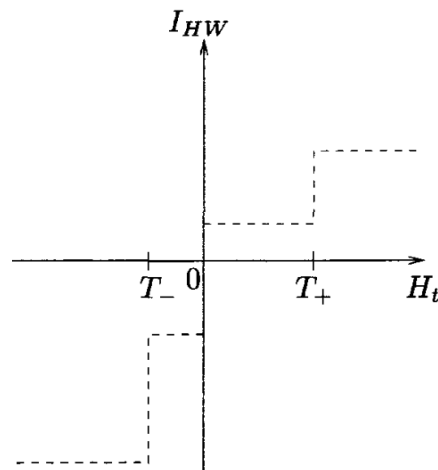


Fig. 6. The function of husband's influence on wife's next reaction  
Source: [7]

The threshold for negativity may be an important dimension of a couple's perception of the relationship. In this context, we say the threshold is "lower" when parameter  $T_-$  is less negative (i.e., closer to zero). That is, a lower threshold means you are more responsive to a stimulus. In their longitudinal studies, the researchers have found out that lower negativity threshold usually leads to less chance of divorce for a couple. It may seem surprising – one might think that happy couples are the ones which tend to show less negativity. However, lower negativity threshold means that the couple is more reactive even to smaller problems, while the couples with higher negativity threshold don't react to small problems and let them grow until they finally explode. This problem also connects to the aforementioned delay problem – waiting too long until a couple gets professional help.

## Conclusions

In this article we discussed many interesting problems concerning mathematical modeling of human relationships. We covered topics such as looking for an appropriate partner, sexual contacts and marriage. There is much more to say in all those topics. For example, looking for an appropriate mate has often been compared to the „secretary problem“, which solution can be applied to love life and to hiring new employees as well. The web of sexual contacts is a problem which can also be described using another branch of mathematics – graph theory. Finally, there were many mathematical studies concerning marriage. In this article all those problems were discussed in a short form. The reader shall feel encouraged to find more information in the literature mentioned below.

## Literature

- [1] P. Backus, *Why I don't have a girlfriend: An application of the Drake Equation to love in the UK*, University of Warwick, Economics Department, 2009
- [2] C. Rudder, *Inside OKCupid: The math of online dating*  
<https://www.youtube.com/watch?v=m9PiPIRuy6E> 21.04.2021
- [3] C. Rudder, *We Experiment On Human Beings!*  
<https://www.gwern.net/docs/psychology/okcupid/weexperimentonhumanbeings.html>  
13.04.2021
- [4] OkCupid, *About OkCupid*  
<https://www.okcupid.com/about> 12.04.2021
- [5] H. Fry, *The Mathematics of Love: Patterns, Proofs, and the Search for the Ultimate Equation*, TED Books, Simon & Schuster, Inc., 2015
- [6] F. Liljeros, C. Edling, L. A. Nunes Amaral, H. E. Stanley, Y. Åberg Y., *The Web of Human Sexual Contacts*, Nature 411 (6840), 2001
- [7] J. Gottman, J. Murray, C. Swanson, R. Tyson, K. Swanson, *The Mathematics of Marriage. Dynamic Nonlinear Models*, Massachusetts Institute of Technology, 2002

## **CORONAVIRUS CASES IN ANIMAL HEALTHCARE**

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### **Abstract:**

Family Coronaviridae (coronaviruses, CoVs), comprises enveloped, positive senseRNA viruses. They are largest RNA viruses identified so far. CoVs are known for over half a century as agents causing respiratory, alimentary or systemic infections. Coronaviruses cause a large variety of diseases in humans, livestock, companion and also in wild animals. Three times in the 21st century, coronavirus outbreaks (SARS, MERS and COVID-19), have emerged from animal reservoirs to cause severe diseases in humans and global transmission concerns. There are hundreds of coronaviruses, most of which circulate among animals including pigs, cattle, ferrets, rabbits, camels, bats, cats and dogs. This review focuses on the etiology, epidemiology, disease mechanisms and pathogenesis as well as biosecurity and immunoprophylaxis against coronaviral infections.

### **Keywords:**

*coronavirus, pets, farm animals, animal protection, pandemic*

### **Introduction**

Coronaviruses are a diverse group of pathogens capable of infecting numerous species of birds and mammals, including humans. They cause a wide spectrum of diseases from the respiratory, gastrointestinal, excretory, and in some cases, the nervous system [1]. They belong to the order Nidovirales, suborder Cornidovirineae, family Coronaviridae, subfamily Orthocoronavirinae, and are divided into four genera depending on their genome structure: alpha-coronavirus (HCoV-229E, HCoV-NL62, TGE-CoV, PED-CoV, FIP-CoV, C-CoV), beta-coronavirus (MH-CoV, BCoV, SARS-CoV, MERS-CoV), delta-coronavirus and gamma-coronavirus (IB-CoV, coronavirus). It is generally accepted that alpha- and betacoronaviruses infect only different mammalian species, while gamma- and deltacoronaviruses infect different avian species, although some of them can also infect some mammals [2]. The name coronavirus is not accidental, it refers to the structure of the envelope of these viruses, which when seen under an electron microscope is crowned by a ring of small structures, shaped like bulbs, obtained by protruding on the surface the knob-like protuberances formed by the S protein, (spike – S). In addition to the S protein, the capsid also contains two other structural proteins, i. e. a small envelope protein (envelope - E) and a membrane protein (membrane - M). In terms of virion size (80-180 nm in diameter) and genome length (about 30,000 nucleotides),

they are among the largest RNA viruses. These pathogens can infect many living organisms including pigs, camels, bats, birds, cats dogs and others [3]. Coronaviruses, like other RNA viruses, are characterized by high genetic variability, which may affect their biological properties, such as pathogenicity, adaptation to new hosts, different cellular or tissue tropism, which sometimes may lead to the appearance of infectious diseases with a previously unknown clinical course [4].

## **Pathogenesis of coronavirus**

Most data on pathogenesis relate to human coronaviruses, especially SARS and MERS, far fewer to animal viruses. In the case of coronaviruses, attention has been paid to tropism to a specific cell type and the nature of cellular receptors, apoptosis, innate non-specific immunity as a first line of defense in viral infections, endoplasmic reticulum stress response as an adaptive stress response pathway, modulation of the mitogen-activated protein kinase (MAPK) pathway. Coronaviruses are characterized by tropism to the cells of the squamous epithelium and epithelium of the lower respiratory tract or non-squamous epithelium, mainly of the small intestine [5]. The human cold-causing coronaviruses (HCoV-229E, HCoV-NL63, HCoV-OC43, HCoV-HKU1) and SARS, MERS, and SARS-CoV-2 are characterized by tropism to the stratified epithelium and lung tissue. The four viruses responsible for causing 1/4 of human colds, pneumonia, bronchiolitis [6] in addition to attacking the respiratory system can also cause gastrointestinal and nervous system diseases [7]. Tropism to epithelial cells of the nasal cavity, tonsils, and lungs, and less frequently to epithelium of the small intestine, brain ganglia, and cerebellum characterizes the coronavirus of vomiting and wasting disease. The small intestinal epithelial cell tropism is characterized by: canine coronavirus (C-CoV), which can also infect liver and spleen cells, feline infectious peritonitis coronavirus (FIP-CoV) infecting also monocytes and macrophages feline enteritis coronavirus (FE-CoV), rabbit infectious enteritis virus (Rb-CoV), TGE virus and ferret epizootic enteritis virus. Equine coronavirus (E-CoV) is characterized by tropism to the intestinal epithelium and respiratory system, infectious bronchitis virus (IB-CoV) is characterized by tropism to the respiratory system, and bovine coronavirus (Bo-CoV) is characterized by tropism to the gastrointestinal epithelium and respiratory system [8]. The interaction between the S-protein and its receptor on the host cell initiates infection, is responsible for the tropism of the virus and for the range of hosts that the virus infects. Apoptosis of virus-infected cells is one of the important mechanisms available to the body to fight infection because it inhibits viral replication. The consequence of the coronavirus-infected organism interaction is a change in the behavior of the immune system, which often leads to the activation or evasion of the immune response. Perhaps proteins encoded by coronaviruses interfere with signaling pathway mechanisms [9]. Coronavirus infection induces endoplasmic reticulum (ER) stress and triggers an adaptive response pathway to this stress, including the unfolded protein response (UPR) pathway. The effect may be the restoration of homeostasis within the reticulum by degradation of abnormal proteins, but also with prolonged stress the promotion of cell apoptosis [10]. Activation of three distinct UPR signaling pathways exerts effects on the mitogen-activated protein kinase (MAP) pathway, autophagy, apoptosis, and enhancement of the natural immune response, thereby affecting viral replication.



## Animal cases of the disease

Tab. 1. Human and animal coronaviruses- susceptible species and target organs

Virus	Sensitive specie	Respiratory system	Gastrointestinal tract	Others
HCoV-229E	Human	Yes, upper section	Yes, small intestine	
TGEV	Pig	Yes, upper section		
PRCV	Pig	Yes, upper section and lungs		viremia
PEDV	Pig		Yes, small intestine and colon	
FIPV	Cat	Yes, upper section	Yes	systemic
FCoV/FECV	Cat		Yes, small intestine	
CCoV	Dog		Yes, small intestine	
CRCoV	Dog	Yes		
RaCoV	Rabbit			Systemic
HCoV-OC43	Human	Yes, upper section		
NUN	Mouse		Yes	Systemic, hepatitis, central nervous system
RCoV	Rat	Yes		Eyes, salivary glands
PHEV	Pig	Yes		Central nervous system
SADS-CoV	Pig		Yes	
PDCoV	Pig		Yes	
BEV	Cow	Yes, upper section and lungs	Yes, small intestine	
IBV	Hen	Yes, upper section	Yes	Kidneys, oviduct
TCoV(TECoV)	Turkey		Yes, small intestine	
SARS-CoV	Human	Yes, lungs	Yes	Viremia, kidneys
MERS-CoV	Human	Yes, lungs	Yes	
SARS-CoV-2	Human	Yes, lungs	Yes	Propably
SARS-CoV-2	Cat, dog, mink, ferret, hamster	Yes	Yes	
Civet cat CoV-2	Civet	Yes	Yes	Subclinical form
Racoon dog CoV	Racoon	Propably	Yes	Subclinical form

Source: [1] S. Le Poder: Feline and Canine Coronaviruses: Common Genetic and Pathobiological Features. Advances in Virology 2011, 609465, [https:// doi.org/10.1155/2011/609465](https://doi.org/10.1155/2011/609465)

### Dogs

There are two coronaviruses in dogs, one causing gastroenteritis (C-CoV, alpha-coronavirus) and the other causing respiratory disease (CR-CoV). Coronavirus infections in dogs occur worldwide. They can have three forms: intestinal, respiratory and systemic. Gastroenteritis mainly affects puppies and has a high mortality rate, especially in neonates, while deaths in older animals are sporadic [11]. The main symptom of the disease, sudden diarrhea, appears 1-7 days after oral infection and is accompanied by signs of weakness and loss of appetite. Feces of liquid consistency with an

unpleasant orange smell, may contain mucus and blood. Circulatory disorders due to dehydration may also occur. Vaccination is used for prophylaxis, but its effectiveness is limited by the antigenic diversity of C-CoV. This is because there are two separate genotypes of this virus. Genotype I replicates poorly in cell culture and its receptor is unknown. Genotype II that replicates well in cell culture has APN receptor-aminopeptidase [12]. In addition to enterotropic strains of C-CoV, pantropic strains exist, such as the highly virulent subtype IIa isolated from dead puppies in Italy in 2005, causing a general infection characterized by fever, depression, vomiting, diarrhea, ataxia and seizures, and leukopenia. Respiratory-causing virus (CRCoV) was first described in the UK in 2003. Infection is spread mainly by droplet infection. CRCoV infection, uncomplicated by other infections, causes a mild upper respiratory tract infection, but in extreme cases may lead to pneumonia [12]. The respiratory form, like the intestinal form, is also mild and usually self cures. Coronavirus causing respiratory disease in dogs (CR-CoV) shares high antigenic relatedness with coronavirus responsible for bovine respiratory disease (Bo-CoV) and coronaviruses causing the human cold [13, 14]. It is likely that CR-CoV is a bovine virus (Bo-CoV) that has crossed the interspecies barrier and adapted to the dog [14]. The disease is spread through direct contact, the aerosol route, through contact with infected environments, rooms and beds, food contaminated with the virus, and through people who may be passive transmitters of CR-CoV.

Clinical signs include fever, sneezing, cough, nasal discharge, and general depression. Some dogs are asymptomatic. The diagnosis is based on the PCR test; nasopharyngeal swabs are the samples for testing [15].

## **Cats**

There are two species-specific coronaviruses in cats feline enteric coronavirus (FECV) causing gastrointestinal symptoms and feline infectious peritonitis virus (FIPV). These are two biotypes of the same virus that differ significantly, mainly in their pathogenic properties [16, 17]. Feline enteric coronavirus (FECV) is common in domestic cat populations worldwide, especially in farm cats and those living in large dens [18, 19]. Coronaviruses are excreted by both asymptomatic carriers and sick cats in feces, saliva and nasal secretions, and urine. Animals can become infected through the oral or aerogenic route. After entering the animal, FECV multiplies in the epithelial cells of the small intestine. Infection in adult cats is usually asymptomatic or mild, but the virus is shed in the feces. Kittens may present with fever, vomiting and diarrhea after weaning but usually recover. Cats that survive infection develop antibodies. The cause of feline infectious peritonitis (FIP), a progressive, debilitating and fatal disease of domestic and free-living cats, is the feline infectious peritonitis virus (FIP-CoV). Infection with the virus biotype that causes infectious peritonitis (FIP) is much less common than FECV. This is due to the fact that the infection does not occur as a result of direct or indirect contact with an infected cat. FIPV infection, depending on the efficiency of the cat's cellular immune mechanisms, can take an exudative form, which is the result of the formation of antigen-antibody immune complexes [16]. The immune complexes settle in the walls of blood vessels, causing inflammation, damage to internal organs, and accumulation of exudates in body cavities. The second form of FIPV infection is the non-exudative form in which granulomas form in the liver, kidneys, central nervous system, or eyeballs. Laboratory diagnosis of coronavirus infection in cats includes clinical examination, examination of body cavity exudates, and hematologic and

biochemical blood tests for the exudative form of FIP. Serological diagnosis is limited due to the inability to distinguish between antibodies directed against FIPV and FECV, but an indirect immunofluorescence test can be used. Studies of SARS-CoV-2 in cats have also been conducted but have been very limited due to the first human cases of infection in December 2019. Reports of asymptomatic SARS-CoV-2 infection in a cat in Hong Kong were published in early April 2020. [20]. Results of RT-PCR testing of nasal and oral swabs and a fecal sample collected from this cat were positive for SARC-CoV-2.

## **Horses**

Among infectious diseases currently threatening horses, equine coronavirus disease caused by equine coronavirus (ECoV, equine coronavirus) plays the most important role. The source of infection is the feces of asymptomatic, diseased and recovered infected horses and foals [21]. The disease is more common in the fall and winter, which is related to horses being indoors and thus more likely to spread infection by direct contact and from an environment contaminated with the virus. In affected horses, virus is shed in the feces between 3-21 days post-infection [21] and up to 99 days post-infection, and seeding may be intermittent [21]. The maximum amount of virus in the feces occurs on day 3-4 of clinical symptoms. An analysis of dozens of clinical cases of ECoV infection in horses showed that the most commonly reported signs were anorexia (97%), lameness (88%), and fever (83%), which ranged from 38.6°C to 41°C. A significant percentage of horses also exhibited a change in the consistency of excreted feces (23%) and micturition (19%). Signs of encephalitis, such as clubbing, pushing the head against the wall, motor clumsiness, nystagmus, retching and convulsions were observed in 3% of infected horses. The target organ of equine coronavirus is the gastrointestinal tract, sometimes additionally the respiratory system. In young foals, lesions are more severe. The virus induces cell apoptosis in MDBK-Madin-Darby Bovine Kidney cell culture [22]. The lesions, despite their nature, do not cause a high percentage of deaths. With morbidity ranging from 10 to 83% [22]. Most often mortality is low, sometimes reaching about 11%. But it can be as high as 27% [22]. The most common cause of deaths are secondary infections caused by disruption of the intestinal barrier, leading to sepsis, endotoxemia and hyperammonemia [23]. Horses over the age of two years are most commonly affected by coronavirus. In different age groups were as follows: 20.5% foals up to 6 months of age, 25.3% horses up to 5 years of age, 54.2% horses over 5 years of age [23]. The incubation period of the disease is 48-72 hours, and the untreated disease usually lasts about a week, when treated it is shorter [24]. In the absence of pathognomonic signs and lesions, the only method of diagnosing coronavirus is the intravital detection of ECoV antigen in the feces, and postmortem detection in small intestinal cells. History is helpful in those cases where horses in the area have previously contracted coronavirus or where outbreaks have occurred or are occurring in the vicinity. Serologic testing is not commonly used due to the lack of commercial diagnostic kits. For prophylaxis, in addition to strict adherence to the rules of bio-care, vaccination trials are being undertaken, with reasonably good results, which take advantage of the occurrence of cross-immunity between ECoV and BCoV. A live attenuated vaccine containing bovine coronavirus was used for this purpose. Horses were vaccinated twice three weeks apart, orally, intranasally, or rectally. Treatment is symptomatic and mainly electrolyte fluid rehydration and nonsteroidal anti-inflammatory drugs are used. In bacterial complications, antibiotic therapy is used.

## **Pigs**

The coronaviruses found in pigs belong to five different species, these are: porcine epidemic diarrhea virus (PEDV), transmissible gastroenteritis virus (TGEV), porcine respiratory coronavirus (PRCV, PRCV), porcine haemagglutinating encephalomyelitis virus (PHEV) and porcine deltacoronavirus (PDCoV). In terms of economic importance in pig production, infections caused by PEDV are the most significant because of its high infectivity and high mortality rate, especially among suckling piglets reaching up to 100%. The characteristic clinical signs of epidemic piglet diarrhea (PED) are watery diarrhea, vomiting and apathy [25]. In Poland, so far, there is no confirmed case of PED, but in the course of many diseases of the digestive system of pigs, in which diarrhoea is observed, the possibility of infection is also taken into account. The virus may spread with purchased animals, which are asymptotically infected and excrete the virus with feces into the environment - manure. Infection of pigs occurs through the oral route, after ingestion of contaminated feed, the virus through the stomach reaches the small intestine PEDV. intestinal villi, which are significantly shortened, resulting in impaired absorption of food content, electrolyte economy, and in the form of symptoms occurs as watery diarrhea with a green or light yellow color [25]. Porcine small intestine sections or fecal samples are collected for diagnosis. For serological diagnosis, blood without anticoagulant is collected. Currently, tests for serological diagnosis of PED by ELISA and molecular diagnosis by PCR are commercially available. In PED prophylaxis, the most important thing is to maintain proper bioassurance rules to prevent the entry of the germ into the herd. Another representative of porcine coronaviruses is the virus causing transmissible gastroenteritis (TGE). There are suggestions that the reservoir between outbreaks and subclinical carriers of TGE-CoV are dogs, cats and wild carnivores. The common starling (*Sturnus vulgaris*) and the housefly may be mechanical vectors of TGE-CoV [26]. In piglets up to three weeks of age, sows infected before and after farrowing have a severe course, while in other age groups the disease is mild and animals rarely die. Infection is spread by fecal-oral and inhalation routes, especially among piglets of the same litter or animals in the same pen. w. The virus can also replicate in the respiratory system and in the mammary gland [27]. Sows that have survived TGE pass specific antibodies to their piglets via colostrum. In herds where piglets come from resistant sows, TGE has an unusual course, with diarrhea occurring mainly in piglets over eight days of age or in freshly weaned piglets. The most important role in the prevention of TGE is played by bio-feeding. In some countries, vaccination of pregnant sows is advocated to protect suckling piglets from disease. Porcine respiratory coronavirus (PRC-CoV) causes subclinical infections or respiratory disease usually with a mild course and is involved in the etiology of porcine respiratory disease syndrome -PRDC. Common clinical signs following PRCV infection of pigs, if any, are dyspnea, accelerated breathing, sneezing, coughing, fever, loss of appetite, and stunted growth. The main target cells for PRCV replication in the lung are type 2 pneumocytes, but PRCV antigens have also been detected in the cytoplasm of bronchial epithelial cells and pulmonary macrophages. Despite differences in pathogenesis and tissue tropism, TGEV and PRCV are closely related antigenically. PRCV induces the formation of specific antibodies in pigs that are difficult to distinguish from TGEV-specific antibodies by commonly used serological tests. To date, one experimental vaccine against PRCV has been described. Since PRCV generally causes subclinical infection, identification of PRCV-positive herds requires regular monitoring by serological tests. Maintenance of a PRCV-negative herd can be achieved by following

strict biosecurity protocols [28]. PHEV, the etiological agent of vomiting and wasting disease (VWD) and/or encephalomyelitis, was the first identified CoV pathogenic to pigs. PHEV is highly prevalent and circulates without clinical signs in most swine herds worldwide. One week after infection, the virus enters with blood into the ganglia of the stomach and brain, causing central nervous system signs. The initial symptoms are vomiting with the consistency of undigested milk curd, followed by impaired motor coordination and collapse due to exhaustion. Nervous form of HE occurs in about 80% of piglets. There are two disease syndromes that are caused by different strains of HE-CoV: vomiting wasting disease (VWD) and encephalic form (EF). No causal treatment or vaccine is available [29]. In 2016, the highly pathogenic swine acute diarrhea syndrome-coronavirus (SADS-CoV) emerged in China causing high mortality in suckling piglets. . Piglets are primarily affected. The mortality rate in piglets 5 days of age or younger is 90%, while in piglets over 8 days of age the mortality rate is less than 5%. Sows have only mild diarrhea and recover within 2 days. Both sick piglets and adult pigs do not develop fever. In addition to fecal-oral infection, respiratory infection is also possible [30]. Piglets develop watery diarrhea, rapid weight loss, and small intestinal lesions consisting of far-reaching villous atrophy. It appears that SADS-CoV does not use any of the known cellular receptors used by other coronaviruses to infect host cells. The pathway by which SADS-CoV is released from an infected cell and spreads in the body is still not fully understood. It is widely believed that coronaviruses use a biosynthetic secretory pathway to spread in the body [31]. SADS-CoV, which is an alpha-coronavirus, may prove to be an equally important cause of epidemics or pandemics in the future due to its potential for rapid transmission between species, likelihood of adaptation to the human body, and causing mass infections, especially once it acquires the ability to spread in the human population via the human-to-human pathway [32].

## **Cows**

Bovine coronavirus (BCoV) causes three disease syndromes in cattle: respiratory infection, calf diarrhea, and winter dysentery. All BCoV isolates to date, although derived from three different bovine syndromes, belong to a single serotype. BCoV is common in cattle populations worldwide. Bo-CoV is also pathogenic in elk, deer, deer, and camelids, and also causes subclinical infections in dogs and turkeys [33]. Coronavirus diarrhea occurs in calves 3-16 weeks of age, and its severity depends on the size of the infectious dose, the age and colostrum immunity of the calves, and secondary infections. Practically, the younger calves become infected, the shorter the incubation period of the disease and the more severe its course. The highest incidence rate occurs in winter due to the stability of the virus at low temperatures. Damaged absorptive cells of the epithelium of the intestinal villi and intestinal mucosa impair digestion and absorption, which in turn contributes to rapid loss of water and electrolytes, resulting in hypoglycemia, acidosis, hypovolemia, and circulatory disorders leading to death, especially of young calves. In respiratory infections that occur in calves 2-6 months of age, the virus localizes in the epithelium of the nasal cavity and trachea, sometimes in the lungs. There is fever, serous nasal discharge, sneezing and coughing [34]. On the other hand, the main clinical sign of winter dysentery is diarrhea, which appears suddenly, mostly in dairy cows, and is mostly watery or hemorrhagic in nature. Domestic cattle are most likely to become infected in pastures also used by wild ruminants. Dairy cows experience a sudden drop in milk production. During an outbreak of winter dysentery, there is a foul-smelling, unpleasantly sweet odor in the barn.



The virus is spread both with feces and with respiratory secretions. RT-PCR, nested RT-PCR, qRT-PCR, ELISA and immunofluorescence test are most commonly used to diagnose infection. There are no specific antiviral drugs against bovine coronavirus. Infected animals are advised to be given broad-spectrum antibiotics to prevent secondary infections. Immunization of dams with inactivated or attenuated vaccines and immunization of calves are used to prevent calf diarrhea. An intranasal vaccine for calves containing live modified Bo-CoV has been developed.

### **Bats**

Bats are hosts for an exceptionally high diversity of coronaviruses. They play an important role in the ecology and evolution of these pathogens as primary hosts and natural reservoirs. Coronaviruses. Prior to 2003, two of the coronaviruses were considered pathogenic to humans and they were: Human Coronavirus 229 and Human Coronavirus OC43. Peter Daszak, has conducted extensive research that has resulted in the discovery of 500 new coronaviruses in bats in 20 countries. One of them, found in a cave in China's Yunnan Province in 2013, was a potential ancestor of SARS-CoV-2, as a comparison of the full genomes of the two viruses showed 96.2% nucleotide sequence similarity [35]. A global SARS epidemic, initiated in November 2002 in China, led to the detection of coronaviruses in horseshoe bats (Rhinolophidae), which proved to be the primary reservoir for both SARS virus and other coronaviruses. The affinity between known human and bat-isolated coronaviruses gives reason to believe that bats may represent a hitherto undiscovered primary reservoir of coronaviruses of epidemic importance. In 2012, in the Middle East, another dangerous coronavirus, MERS-CoV, was detected in a man hospitalized with symptoms of respiratory syndrome and is also likely to have originated from bats. It is suspected that humans may have contracted MERS-CoV by eating dead infected bats, however this hypothesis has not been confirmed. Given that there are more than 1,000 species of bats and bats are present in every corner of the world, it is almost certain that future outbreaks of zoonoses will be traced back to bats.

### **Birds**

Coronaviruses have been isolated from many bird species, including peacocks, partridges and cyranids, guinea fowl, pigeons, gray geese and mallard ducks [36]. Coronaviruses belonging to the genera Gammacoronavirus and Deltacoronavirus are found in representatives of the Aves cluster. One of the more dangerous viruses causes infectious bronchitis, a disease that causes extremely severe losses in the poultry industry worldwide. In addition to respiratory symptoms, IB can also impair reproductive function, leading to drastic declines in egg production and egg quality. This multiplicity of disease manifestations is associated with the wide variety of IBV variants that exist, influencing its tropism and pathogenicity, and thus the form of the disease course. Infection is spread by the respiratory route, most commonly by direct contact, but transvaginal infection is possible, as well as by the faecal-oral route. Birds of any age, breed, and sex are affected. In its chronic course, the disease can last several weeks with a mortality rate of 5-25%. Immunoprophylaxis is by vaccination using vaccines based on the highly immunogenic IB-CoV strain, but still the effectiveness of vaccination leaves much to be desired. Deltacoronavirus belongs to the same subgenus Buldecovirus as porcine and sparrow deltacoronavirus, suggesting transmission between these species [37]. It is believed that free-living birds, due to their ability to live in close proximity to



humans and poultry farms, may play an important role in the spread of coronaviruses into poultry populations, as well as being a potential source of variation in these viruses leading to the generation of new variants [38].

### **Others**

Mouse hepatitis coronavirus (MH-CoV) causes inflammation of the gastrointestinal tract and liver and demyelinating encephalomyelitis with an acute or chronic course and has been used to study the pathogenesis of coronavirus. A coronavirus (Eri-CoV) with phylogenetic relationship to MERS-CoV and bat clade c coronavirus (Bt-CoV) has been isolated from European hedgehogs (*Erinaceus europaeus*). Also in beluga whales with respiratory disease and liver disease, large numbers of gammacoronavirus copies are found in the liver [39]. There is speculation that alphacoronavirus is the cause of death in seals.

### **Conclusion**

This article aims to provide an overview of the coronaviruses, their pathogenesis and distinctiveness, as they form a large and diverse group of viruses found in many mammalian and avian species, characterized by a high degree of variability and a relatively high potential to break interspecies barriers. As I mentioned above, CoVs have been known for more than half a century as causative agents of respiratory, gastrointestinal, or systemic infections in domestic and wild birds, so they have surrounded us in everyday life for a long time. Zoonoses are a common field of medical and veterinary science. The dynamics of viral zoonoses in the last two decades have been surprising, with unexpected ongoing events threatening human health and life. It is even believed that 75% of newly reported infectious diseases are of animal origin, with a source in wildlife. It is necessary to intensify basic research aimed at a more accurate understanding of the diversity of coronaviruses found in the free-living reservoir. This will allow the selection of potential "candidates" with high zoonotic potential that could pose a pandemic risk in the future. The appearance of SARS-CoV-2 confirms the fact that we do not know the full list of human and animal pathogens responsible or co-responsible for causing various diseases.

### **Literature**

- [1] S. Le Poder, *Feline and Canine Coronaviruses, Common Genetic and Pathobiological Features*, *Advances in Virology*. 2011, 609465, [https:// doi.org/10.1155/2011/609465](https://doi.org/10.1155/2011/609465)
- [2] *International Committee on Taxonomy of Viruses*. 2021  
<https://talkictvonline.org> 17.02.2021.
- [3] K. Pyrc, *Ludzkie koronawirusy*, *Postępy Nauk Medycznych*. (2015), Vol.28, 48-54.
- [4] J. Cui , F. Li, Z. Shi, *Origin and evolution of pathogenic coronaviruses*. *Nature reviews. Microbiology*. (2019), Vol. 17, 181–192.
- [5] T. S. Fung, D. X. Liu, *Human coronavirus, Host – pathogen interaction*. *ReY Microbiol*. (2019), Vol. 73, 529–557.

- [6] L. Van der Hoek, *Human coronaviruses: What do they cause?* Anti- vir. Ther. (2007), Vol. 12, 651–658.
- [7] N. Arbour, R. Day, J. Newcombe, P. J. Talbot, *Neuroinvasion by human respiratory coronaviruses.* (2000), Vol. 74, 8913–8921.
- [8] R. W. Fulton, H. R. Herd, N. J. Sorensen, A. W. Confer A, J. W. Ritchey, J. F. Ridpath, J. L. Burge, *Enteric disease in postweaned beef calves associated with Bovine coronavirus clade 2.* J. Vet. Diagn. Invest. (2015), Vol. 27, 97–101.
- [9] M. Frieman, M. Heise, R. Baric, *SARS coronavirus and innate immunity.* Virus Res. (2008), Vol. 133, 101–112.
- [10] T.S. Fung, D. X. Liu, *Coronavirus infection, ER stress, apoptosis and innate immunity.* Front. Microbiol. (2014), Vol. 5, 296.
- [11] M. J. G. Appel, P. Meunier, R. Pollock, H. Greisen, L. Carmichael, L. Glickman, *Canine viral enteritis, A report to practitioners.* Canine Pract. (1980), Vol. 7, 22–23.
- [12] A. Pratelli, N. Decoro, A. Tinelli, V. Martella, G. Elia, M. Tempesta, F. Cirone, C. Buonavoglia, *Two genotypes of canine coronavirus simultaneously detected in fecal samples of dogs with diarrhea.* J. Clin. Microbiol. (2004), Vol. 42, 1797–1799.
- [13] K. Erles, J. Brownlie, *Canine respiratory coronavirus: an emerging pathogen in the canine infectious respiratory disease complex.* Vet. Clin. North Am.. Small Ani. Pract. (2008), Vol. 38, 815–816.
- [14] K. Erles, C. Toomey, H. Brooks, J. Brownlie, *Detection of a group 2 coronavirus in dogs with canine infectious respiratory disease.* Virology. (2003), Vol. 310, 216–223.
- [15] S. R. Weiss, S. Novas-Martin, *Coronavirus pathogenesis and the emerging pathogen Severe Acute Respiratory Syndrome coronavirus.* Microbiol. Mol. Biol. Rev. (2005), Vol. 69, 635–664.
- [16] A. Pratelli, *Genetic diversity of a canine coronavirus detected in pups with diarrhoea in Italy.* J. Virol. Methods (2003), Vol. 110, 9–17.
- [17] K. Erles, *Detection of a group 2 coronavirus in dogs with canine infectious respiratory disease.* Virology. (2003), Vol. 310, 216–223.
- [18] T. Hohdatsu, S. Okada, H. Koyama, *Characterization of monoclonal antibodies against feline infectious peritonitis virus type II and antigenic relationship between feline, porcine, and canine coronaviruses.* Arch. Virol. (1991), Vol. 117, 85–95.
- [19] T. Hohdatsu T, *The prevalence of types I and II feline coronavirus infections in cats.* J. Vet. Med. Sci., (1992), Vol. 54, 557–62.
- [20] A. Almendros, *Can companion animals become infected with Covid-19?* Vet. Rec. (2020), Vol. 186, 419–420.
- [21] M.G. Sanz, S. Y. Kwon, N. Pusterla, J. R. Gold, F. Bain, J. Evermann, *Evaluation of equine coronavirus fecal shedding among hospitalized horses.* J. Vet. Intern Med. (2019).
- [22] K. Suzuki, Y. Matsui, Y. Miuraa, H. Sentsui, *Equine coronavirus induced apoptosis in cultured cells.* Vet. Microbiol. (2008), Vol. 129, 390–395.
- [23] C. L. Fielding, J. K. Higgins, J. C. Higgins, S. McIntosh, E. Scott, F. Giannitti, A. Mete, N. Pusterla, *Disease associated with equine coronavirus infection and high case fatality rate.* J. Vet. Intern. Med. (2015), Vol. 29, 307–310.

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- [24] N. Pusterla, R. Vin, C. M. Leutenegger, L. D. Mittel, T. J. Divers, *Enteric coronavirus in adult horses*. Vet. J. (2018), Vol. 231, 13–18.
  - [25] L. J. Saif, *Coronaviruses, Diseases of swine*. Editors. (2012), p. 501–524.
  - [26] OIE, *Transmissible gastroenteritis*. Manual. (2018), 1627–1638.
  - [27] L. J. Kemeny, V. L. Wiltsey, J. L. Riley, *Upper respiratory infection of lactating sows with Transmissible Gastroenteritis virus following contact exposure to infected piglets*. Cornell Vet. (1975), Vol. 65, 352–362.
  - [28] K. E. Killoran, K. R. Leedom-Larson, *Porcine respiratory coronavirus*. Swine Health Information Center and Center for Food Security and Public Health. (2016).
  - [29] J. C. Mora-Diaz, P. E. Piñeyro, E. Huston, J. Zimmerman, L. G. Giménez-Lirola, *Porcine hemagglutinating encephalomyelitis virus*. Front. Vet. Sci. (2019).
  - [30] P. C. Woo, S. K. Lau, C. C. Tsang, C. C. Lau, P. C. Wong, F. W. Chow, J. Y. Fong, K. Yuen, *HKU15 in respiratory tract of pigs and first discovery of coronavirus quasi species in 5'-untranslated region*. Emerg. Microbes Infect. (2017).
  - [31] M. Robinson, S. Schor, R. Barouch-Bentov, S. Einav, *Viral journeys on the intracellular highways*. Cell. Mol. Life Sci. (2018), Vol. 75, 3693–3714.
  - [32] S. Ghos, T. A. Dellibovi-Ragheb, E. Pak, Q. Qiu, M. Fisher, P. M. Takvorian, C. Bleck, V. Hsu, A. R. Fehr, S. Perlman, S. R. Achar, M. R. Straus, R. R. Whittaker, C. A. M. de Haan, G. Altan-Bonnet, N. Altan-Bonnet,  *$\beta$ -Coronaviruses use lysosomal organelles for cellular egress*. bioRxiv.
  - [33] S. Perelman, J. Netland, *Coronaviruses post-SARS: update on replication and pathogenesis*. Nat. Rev. Microbiol. (2009), Vol. 7, 439–450.
  - [34] R. W. Fulton, H. R. Herd, N. J. Sorensen, A. W. Confer, J. W. Ritchey, J. F. Ridpath, J. L. Burge, *Enteric disease in postweaned beef calves associated with Bovine coronavirus clade 2*. J. Vet. Diagn. Invest. (2015), Vol. 27, 97–101.
  - [35] J. Zaugg, *The virus hunters who search bat caves to predict the next pandemic*. 26 April 2020.
  - [36] D. Cavanagh, *Coronaviruses in poultry and other bird.*, Avian Pathol. (2006), Vol. 34, 439–448.
  - [37] S. K. P. Lau, *Discovery and Sequence Analysis of Four Deltacoronaviruses from Birds in the Middle East Reveal Interspecies Jumping with Recombination as a Potential Mechanism for Avian-to-Avian and Avian-to-Mammalian Transmission*. J. Virol. (2018), Vol. 92(15).
  - [38] M. A. Rohaim, *Reverse spillover of avian viral vaccine strains from domesticated poultry to wild birds*. Vaccine. (2017), Vol. 35, 3523–3527.
  - [39] K. A. Mihindukulasuriya, G. Wu, J. St Leger, R. W. Nordhausen, D. Wang, *Identification of a novel coronavirus from a beluga whale by using a panviral microarray*. J. Virol. (2008), Vol. 82, 5984–5988.

# DIFFERENT PERCEPTIONS OF THE THREAT OF RADIOACTIVITY IN THE CONTEXT OF THE DEBATE ABOUT USING NUCLEAR POWER PLANTS TO MITIGATE CLIMATE CHANGE

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## **Abstract:**

I present various perceptions of the threat of radioactivity as a source of conflict around the use of nuclear power to reduce greenhouse gas emissions and mitigate the effects of climate change by reducing the use of fossil fuels for energy production. I take at beginning the debate around nuclear power in contemporary media, then use discourse analysis to examine culturally embedded discourses of fear of the threats of radioactivity, and propose a shift in the conceptual categories used to describe human relations with the environment using a new conceptual apparatus proposed by multispecies ethnography. Finally, I answer the question of why we should include the achievements of the humanities and social sciences in the study of the environment, which would help to shed new light on the problems of these relations and, in the context of this article, help to solve the dilemmas related to the use of nuclear power plants for energy production as an alternative to conventional sources.

## **Key words:**

*nuclear power generation, discourse analysis, renewables, natureculture*

## **Nuclear energy in the context of climate change**

If we as humans are to avoid the worst effects of anthropogenically induced climate change, we must drastically reduce our greenhouse gas emissions. Thus, climate change, caused by the impact of human activity on the environment, has now become the most important framework for analyzing energy production technologies, as it is largely the result of burning fossil fuels just for energy production.

In recent years, many publications on climate change have been published, both scientific, concerning its causes [1] or predicting its development in the future [2], as well as popular science, aimed at making the public aware of human pressure on the environment and presenting the resulting risks [3]. However, in the context of energy generation as well as consumption, it should be stated that for many years this industry has been developing at an increasingly rapid pace, with the arrival

of new devices that run on electricity, as well as the progressive development in undeveloped areas, so that more and more people are included in the electrification and informatization processes. The development of world electricity consumption over the last decades is well illustrated in the following graph.

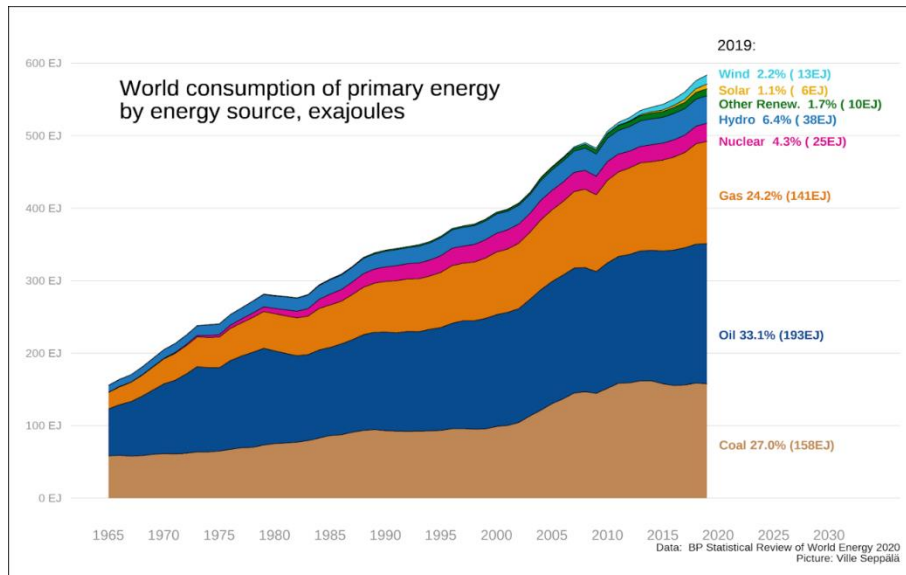


Fig. 1. Growth of world electricity consumption by source in the energy mix from 1965 to 2020.  
Source: BP Statistical Review of World Energy 2020.

The increasing consumption of energy, and hence its production, predominantly from fossil sources such as coal, oil, and natural gas - which, according to the graph above, together account for almost 85% of global energy production - is responsible for the increase in the emission of a correspondingly increasing amount of greenhouse gases into the atmosphere. The upward trend in greenhouse gas emissions can be seen in the following graph.

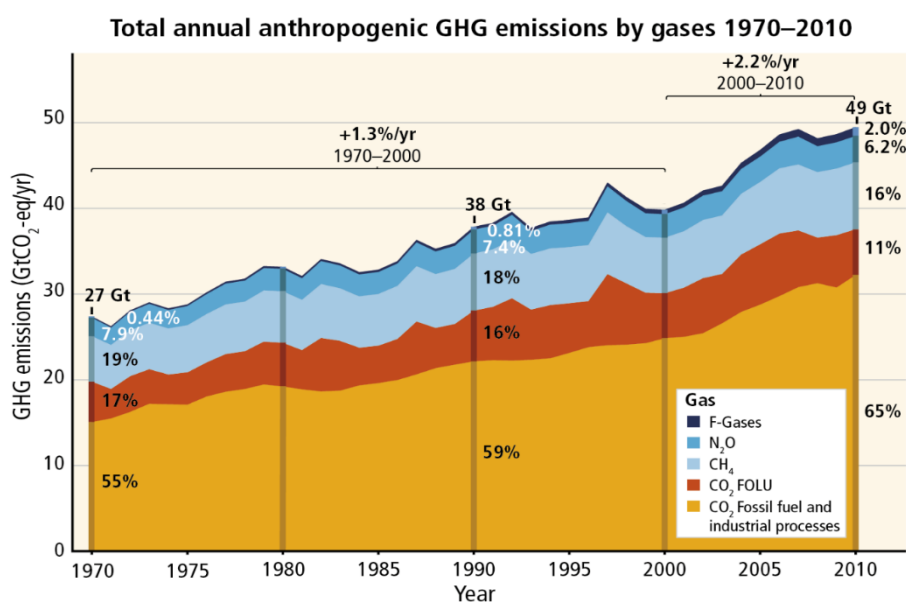


Fig. 2. Growth in global greenhouse gas emissions by chemical compound from 1970 to 2010.  
Source: Intergovernmental Panel on Climate Change.

In the world, there is a discussion about moving away from energy production based on burning fossil fuels and replacing them with renewable energy sources. These plans, however, face difficulties in the form of distribution of installation costs, occupation of large areas of land, as well as variable effectiveness, since we also have such weather conditions when there is no wind and no light at all. As an answer to such difficulties, nuclear technology, including the need to build a nuclear power plant in Poland (plans for which are more and more often announced by the government [4]), is more and more often referred to, however, such an approach is met with resistance from the society and sometimes also with criticism from pro-environmental movements themselves.

An example of a statement by a scientist openly interested in environmental protection, but opposed to investing in nuclear power, is the article by climate scientist Marcin Popkiewicz published on [wysokienapiecie.pl](http://wysokienapiecie.pl), in which he states that "we have better solutions than the atom" [5]. According to the author's argumentation, photovoltaic panels and wind generators should have the first place in energy production in Poland, and when there is no wind or total cloudiness, we should compensate for the lack of energy in the system by burning biofuels from agricultural production, hydrogen, or storing energy in batteries or gravity power plants, as well as... importing it from neighboring countries. The role of nuclear power plants, which are a low-carbon source of energy, the author would like to see as only marginal, referring to IPCC reports predicting that in the future "the atom will have its role in decarbonization, complementing RES (renewable energy sources) and in 2050 having a few percent shares in the global energy mix" [5]. The only problem is that currently in Europe, as much as 25% of demand for energy is produced in this way by nuclear power plants [6], and in some countries, the atom is a dominant source in the energy mix – for example, in France, it is almost 75% (which is more or less the same as the level of energy used by Poland from coal power plants), and the rest of demand is supplemented by energy from renewable sources with a minimal percentage of coal and gas power plants [7].

Adam Błażowski polemically comments on Popkiewicz's article, openly stating that the goal of protecting the climate against global warming cannot be achieved without including energy from nuclear power plants, as attempts to base the entire energy system on RES and, for instance, biofuels on a global scale would result in too many negative consequences for the natural environment. He argues that in such a system there are currently "almost 10 thousand biogas plants operating in Germany, and cultivation of energy crops and biofuels occupies as much as 7% of the entire country and as much as 18.5% of arable land. These are mainly corn monocultures, fertilized and treated with plant protection products, industrially harvested and transported for energy" [8]. Moreover, in the case of the German system, these quantities are insufficient and there is also a significant import of biomass from other countries, which incur analogous environmental costs at home. Here, Błażowski takes the view that it is better to invest "in a few reactors at two industrial plants and we can try to give away 7% of the country's area to nature". Similar opinions are expressed by scientists, who agree that investing in nuclear energy is crucial for preserving biodiversity. This is the result of, among others, the research work of Brook and Bradshaw, described in the article *Key role for nuclear energy in global biodiversity conservation* [9], and the subject of a letter by 75 professors agitating for the consideration of biodiversity conservation as part of the work on decarbonizing the energy system, in which they write: "Although renewable energy sources like wind and solar will likely make increasing contributions to future energy production, these technology options face real-world



problems of scalability, cost, material, and land use, meaning that it is too risky to rely on them as the only alternatives to fossil fuels. Nuclear power – being by far the most compact and energy-dense of sources – could also make a major, and perhaps leading, contribution. As scientists, we declare that an evidence-based approach to future energy production is an essential component of securing biodiversity's future and cannot be ignored. It is time that conservationists make their voices heard in this policy arena" [10].

In a similar vein Polish scientists also express their opinions, e.g. in the official communiqué of the Interdisciplinary Advisory Group on Climate Crisis to the President of the Polish Academy of Sciences we can read that "in Polish environmental conditions (lack of opportunities for significant development of hydro and geothermal energy, low insolation in the cold season and long windless periods in much of Europe) nuclear energy should play an important role in closing the decarbonization. It is therefore necessary to systematically work across political divides on its safe development and to build public support for this solution" [11].

It would seem, therefore, that in the scientific field the role of nuclear power in reducing climate change has already been recognized, as well as the logical consequence of agitating for the construction of more such power plants. However, in part of Polish society, including environmentalists, there is a deep-rooted aversion to nuclear energy, which will lead to blocking plans to invest in this technology of energy production, even though it seems to contradict available data. According to Prof. Szymon Malinowski, co-founder of the naukaoklimacie.pl website, sociology should respond to such challenges, but in his opinion, this is due to the perception of nuclear energy as some kind of "concentrated evil" and indicates that "perhaps it is an effect of various military nuclear tests, which were destructive for the environment (...) which is also probably related to radiation phobia, i.e. the fear of being irradiated". [12]. In the remainder of this article, I would then like to proceed to describe the various discourses present in society, which are the result of, among other things, historical dependencies, and which, in my opinion, account for this negative perception of nuclear power. By doing so, I would like to elaborate on Prof. Malinowski's intuition regarding the sources of reluctance towards this emission-free technology of energy production in the ingrained fear of the phenomenon of radioactivity.

## **Dialectics of discourses on the threat of radioactivity**

In Poland, the largest anti-nuclear protests to date were against the Żarnowiec Nuclear Power Plant, which had been under construction since 1972. They intensified after the Chernobyl disaster in 1986, when the world became aware of the dangers of using this technology to produce electricity. On February 24, 1989, protesters took to the streets of Gdansk carrying banners with slogans such as: „Atomowy elementarz zaprowadzi cię na cmentarz”, „Chcemy papier toaletowy nie reaktor atomowy”, „Zdrowsze muchomory niżli reaktory”, „Jądrowy Żarnowiec – narodowy grobowiec”, „Bez atomu w naszym domu” and „Boję się Żarnowca”<sup>1</sup>. These protests proved to be successful, because due to political reasons, including the events of 1989 and the subsequent transformation of the political system, the construction of the power plant was stopped and then, in the 1990s, the

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<sup>1</sup> Own materials collected by the author.

project was declared closed. In the social perception, the threat of another Chernobyl-like disaster was dismissed. Despite the fact that the Żarnowiec power plant was to have a reactor of a completely different type than the one that led to the explosion in Chernobyl.

From a contemporary perspective, the most significant observation would be that at the time, fear of the unknown threat of a "radioactive atom" was strong enough to drive people to organize mass protests. And just as these were unprecedented events in the Polish context, such protests, as well as references to communitarian fear, occurred much more frequently in the West. In the following, I will try to show that this has its origins in the discourses that emerged during the Cold War, when there was a kind of "tug-of-war" between the sides of governments trying to hide the real level of threat and citizens who, because of their lack of scientific knowledge, preferred to have nothing to do with technology that they saw as lethal. In this subsection, therefore, I would like to focus on describing the dialectic between the discourses present in pop culture, including official government announcements, where, on the one hand, the technology of using atomic energy is presented as a way to destroy the world, and on the other, as a threat no greater than other sources of energy, whose failures can always happen, so they should not be feared.

A work written in the vein of the first of the distinguished discourses is the novel *On the Beach* by Nevil Shute [13], widely known in pop culture due to its anti-atomic message. The book tells the story of the last months of people's lives in Australia, which is gradually reached by a radioactive cloud spreading with the movements of the atmosphere. The picture is all the more poignant because no sensational events actually take place in the lives of the characters. The social reality does not change dramatically. The annihilation reaches Australians – and the reader – through seemingly trivial events, such as moving the annual golf tournament to August. The intention behind this action, however, is the familiar, to everyone in the world depicted by the author, conviction of the inevitability of a catastrophe that will leave no one left to play in the golf tournament in September. In such a world, there is no reason to do anything either, even though the characters in the novel live their daily lives to maintain a sense of life and to pretend that existence is not about to end.

One scene in particular in the novel has passed into the canon, in which several of the characters take a submarine to uncharted territories to see if there are still livable places on Earth. At this point, the author draws a scene of horror in your characteristic style, the ineffability of the interruption is built up with ways of describing everyday life. Indeed, the boat crew does not encounter mass destruction. Instead, they enter the bay by a picturesque, sleepy town where the stores and houses look as if their owners have left for a while. In the building of a radio station that has been sending out a dead signal the whole time, they find a pack of cigarettes lying on a table. The ordinary, unused cigarettes lying on the table, but observed from behind the glass of the protective suit, carry radioactive death. For they can no longer be picked up, yet they look ordinary. This is the paradox of the indescribability of the threat of radioactivity, which can hide in any, even the most ordinary object, which the author wants to evoke in the audience.

The energy of the atom, by its scale and the phenomena it produces – the vague, inexplicable effect of radioactivity based on sensory experience – goes beyond the zone of the known and knowable for the average person and is a kind of mystery taken on faith. It is something else, something demanding an explanation or adaptation of explanatory schemes that will in any way embrace it, if not approximate it. This embracing is the challenge that nuclear energy poses to mass

discourse in particular. For how can we know that radiation is taking place? Who is in a position to investigate it? Will issues of safety (survival) in the event of an accident, disaster, "technical problems" be thrown on faith or disbelief that radioactive particles exist and "fly" around us? This is the most important challenge facing modern science, because if, thanks to it, we were to build nuclear power plants capable of supplying electricity to all citizens while minimizing human impact on the environment, we should also use it to make the public aware of real, possible threats in case of an accident. Without evidence-based knowledge, the nuclear fear discourse will, perhaps irrationally but completely realistically, tend to exaggerate the scale of the threat that the use of this technology may cause, and as a result, work towards stopping the operation of facilities operating in this way.

The vision outlined by Nevil Shute can be considered a total vision, as it shows the end of the hitherto known normalcy – a kind of certainty that everything we surround ourselves with, touch every day, is what it is to us, what we call it, how we use it, and in all of this, it is relatively safe. In the world depicted in *On the Beach* this certainty is shattered by the threat of radioactivity, which may not be definite or certain in every case, but whose possibility of occurrence means that previously familiar objects will never be the same again. One could say that they have been "contaminated" by culture, because their hitherto natural form and role have been effectively covered by a layer of meanings, through which they will have to recede into the background, and the people using them so far will have to change their established habits. Now, the completely "natural" pack of cigarettes acquires new characteristics, it ceases to be as we have known it so far, it ceases to be a box with lumps of dried tobacco leaves wrapped in thin paper tissue, which would carry no significant weight for the natural environment. Now they constitute a new source of danger of cultural provenance, because something extremely unnatural must have happened, since it is better not to approach it to avoid exposing oneself to a dose of radiation, which in consequence can affect one's health and life. Questions of imagining the unimaginable are invoked very often today. The totality and uncompromisingness of such a radical disruption of the certainty of action in the world as we knew it is reminiscent of contemporary attempts to imagine a world after the end of the climate catastrophe, when the changes caused by global warming acted with such force that we did not survive on Earth as a species. Such a catastrophe could lead to the annihilation of the entire world - the entire world, at least for humans - because from our perspective, if we are gone, there will be nothing left. For this reason, the vision of an Earth without humanity is unique in the humanities (though quite inspiring to them), for they will not be able to apply any of their research methods if the world is stripped of the human element. The question of describing how to imagine a vision of a future without humans was taken up by Alan Weisman in his best-selling book *The world without us*, in which he proposed the following thought experiment: "Suppose the worst has happened. Consider the extinction of humanity as a fait accompli. [...] Imagine a world from which we all suddenly disappear [...] Will there be any fragile, lasting trace of us left in the universe? [...] Is it possible that instead of issuing a great biological sigh of relief, the world would begin to miss us?" [14]. The above experiment in anthropology was later used by a leading contemporary humanist of Indian origin, Dipesh Chakrabarty, in an attempt to describe the difficulties we have to face in the context of fear of inevitable phenomena beyond our control, such as the climate catastrophe:

"I am drawn to Weisman's experiment as it tellingly demonstrates how the current crisis can precipitate a sense of the present that disconnects the future from the past by putting such a future

beyond the grasp of historical sensibility. The discipline of history exists on the assumption that our past, present, and future are connected by a certain continuity of human experience. We normally envisage the future with the help of the same faculty that allows us to picture the past. Weisman's thought experiment illustrates the historicist paradox that inhabits contemporary moods of anxiety and concern about the finitude of humanity. To go along with Weisman's experiment, we have to insert ourselves into a future 'without us' in order to be able to visualize it. Thus, our usual historical practices for visualizing times, past and future, times inaccessible to us personally—the exercise of historical understanding—are thrown into a deep contradiction and confusion. Weisman's experiment indicates how such confusion follows from our contemporary sense of the present insofar as that present gives rise to concerns about our future. Our historical sense of the present, in Weisman's version, has thus become deeply destructive of our general sense of history" [15].

I find the above analyses of understanding the consequences of climate change in the humanities to be very much in line with analyzing fears of radiation, including the use of atomic energy to generate electricity. For in both cases, one can experience the extremes of not being able to imagine a post-catastrophe world - on the one hand, it will be the result of the climate catastrophe towards which we are moving as humanity with each rising level of greenhouse gas emissions on the graph, on the other hand, it will be the fear of an un(dis)cognizable radiological catastrophe if the technology of energy production in nuclear power plants, which is supposed to be our remedy to prevent a climate catastrophe, turns against us and there is a catastrophe of radiation contamination of the ecosystem, as in the case of the mentioned Chernobyl power plant.

The second type of discourse generated around the issue of radioactivity, also dating back to Cold War realities but which has remained alive in society, is the signature approach taken by the government side in the materials made available to reassure citizens that there is no risk. Many different materials have attempted to achieve this effect by spreading the narrative that radiation is nothing new, and that it is a perfectly natural phenomenon and should be treated as such, so we should not worry about it. The gloomy visions of doom predicted in works of culture were to be neutralized by the governmental discourse, which was to do everything possible to diminish the perceived threat in radioactivity and to eliminate social fears about this un(dis)cognized danger.

Comparison and analogy are at its core, and the goal is to tame and create the impression that what is completely different can easily become little or no threatening part of everyone's everyday life. The state administration will do this by, among other things, protecting citizens from the consequences and giving them the knowledge and "tools" of what to do in case of a threat such as an accident.

An American civil defense propaganda film, with the telling title *Duck and cover!* [16] and the similar *Survival under Atomic Attac* [17], as well as *Protect and Survive* [18] produced by the British Civil Defence, give a good picture of the survivalist discourse, supported and promoted by the state [19]. At the same time, they are important texts of Cold War classics that are quite often commented (and parodied) contemporaneously. All the above-mentioned positions are preceded by an introduction, which is intended to create a certain attitude and promote the desired way of thinking about the threat. It is to think in terms of analogies, comparisons to things known and long mastered. The film *Duck and cover!* is a nine-minute instructional piece aimed at children and shown in schools

at the beginning of the Cold War. Here's how it talks about the dangers of radioactivity, caused in this particular case by the explosion of an atomic bomb:

"We all know that the atomic bomb is very dangerous, and since it can be used against us, we must prepare for it, just as we prepare for other kinds of dangers that threaten us all the time. Fire is dangerous - it can burn down whole buildings if someone is careless. But we are prepared for fire. We have a great fire department to put out fires. (...) Cars can be dangerous too. Sometimes they cause nasty accidents. But we are ready: we have traffic rules that drivers and pedestrians must follow. Now we must prepare for a new danger: the atomic bomb" [17].

What is interesting for the anthropologist in all this is the question of thinking in magical categories, the task of which is to accustom the citizen with the awareness of the presence of atomic energy on the agenda, through the creation of simple defensive scenarios against the dangers posed by the use of this energy. In the texts in question, the methods by which the nuclear nightmare can be avoided are simple and easy to remember. In Duck and cover! It will be the title method - hide and cover! - all you have to do is find a wall to throw yourself against, curl up against it, cover your neck with your hands and then get up, shake off the radioactive dust and go about your daily business. In one scene in the film, we see a boy who, upon seeing the flash, jumps off his bicycle and crawls under the curb. A voiceover explains "Tony lies down and doesn't move until he is sure the danger has passed." After a moment, an adult approaches, picks up Tony, hands him his bike, and the boy smiles and moves off in the same direction he was going before the atomic bomb exploded. Here, the danger from the release of atomic energy is not apocalyptic, it ends at some point (and that is for sure, which is easy to observe by an ordinary passerby), and the world, with the help of responsible adults and obediently sheltered children, returns to normalcy.

In this vision of the world, the threat of radioactivity from a nuclear bomb explosion or a potential accident at a power plant does not exist. Dust is dust, hot air is indeed hot, and a shock wave will, say, break a window, but the threat of radiation is not there, after all, as N. Sinev, deputy chairman of the State Committee on the Use of Atomic Energy of the USSR "Nuclear reactors are ordinary furnaces, and the operators controlling them are smokers" [19]. There are no thyroid diseases, no skin lesions, no developmental defects. In Cold War propaganda films, you can smoke cigarettes – rest assured, as long as they are lying on a rubbing surface and have already cooled down after the hot dust fallout from the explosion they certainly won't hurt anyone.

The problem of dispelling myths and arriving at true knowledge has been a prominent part of the literature accrued during the Cold War, when there was a debate between hardened pacifists and supporters of nuclear disarmament and scientists and government officials about the benefits and dangers of harnessing the energy from nuclear reactions. In this clash, opponents of building nuclear power plants or atomic bombs have nothing to defend their position except vague, Cassandra tales of doom, the end of the world, and the harmfulness of radiation that no one has ever seen. Scientists, on the other hand, appeal to their methods.

What is important is not only the content of the message in the discourse of the state administration (a discourse created in Cold War times, but security issues are so universal that they can be used for policy purposes in other historical contexts as well) but also its form. Since scientists and those promoting films about the harmlessness of a nuclear explosion (whether from a bomb or a reactor) and the associated radioactivity have possessed the knowledge and destroyed the myths,



everyone else deserves mockery or even indulgence. Another classic survivalist film, *The Medical Aspects of Nuclear Radiation* [20], also made during the Cold War era, not only tells the story of radiation's effects on human health and the human body, but also clears up widespread misconceptions about radiation:

“There are many beliefs about radioactivity, widely held by people, in which it is likened to a powerful and unstoppable evil Indian spirit. (...) Radiation is dangerous, but to say it kills and period is like giving a straight answer to the question 'How high up is it?' Radium-coated hands of your watch, for example, are harmless”.

And yet the energy of the atom, and the chain reaction of its release, is qualitatively different from any other natural or artificial process encountered by man. One can try to express the explosion by means of an apocalyptic vision of the end of the world, thus inclining the description towards fragmentarity, randomness, speaking through insinuation, as Nevil Shute did in his novel. Or it can be seen in terms of the familiar, the known, the well researched, what one has become accustomed to. These are two opposing modes of human behavior when confronted with something quite different - unthinkable in its scale of nuclear threat.

It is, however, short-sighted to turn to one or the other way of narrating nuclear technology and its possible dangers, because it is possible to go beyond the dualism of "a natural harmless phenomenon" vs. "a deadly anthropogenic threat". There is no point in trying to separate the two, just as there is no point in discussing the cultural or natural provenance of radioactivity.

## **On the role of the humanities in the study of technologies**

To conclude this article, I would like to take a stand on the futility of trying to divide the world into cultural and natural realities. Until now, such a division of nature/culture, has been the axis of analysis for many topics when anthropologists work with various ethnic groups. But nowadays we have too much evidence to know that continuing to maintain a strong division between such two analytical categories does more to hinder our view of the world and the laws and connections that govern it than to help us actually understand any of it. In the field of anthropology, an attempt to move beyond this dichotomy was proposed by researcher Donna Haraway.

In her publications, Haraway proposed conceptual categories that allow for a new constitution of man's relations with the world around him: with other organic entities with which he is permanently "associated" and with what we would culturally call the sphere of nature (so far conceived as the zone of the absence of culture [21]), which together transform into an integrated “naturoculture”. Thanks to this, each relation between the elements of the natural environment and the products of culture (the hands of man) is a whole world of relations co-constituting each other, for it is impossible to take away one category from them lest the whole should suffer, because, as the author herself says: “it concerns, therefore, the implosion of nature and culture into the relentlessly historically specific, shared lives of human beings (...). I would like to convince my readers that we are, in word and in fact, inhabitants of technoculture, part of the symbiogenetic, naturocultural fabric” [22].

Changing the conceptual categories used to describe the relationship between humans and the natural environment is important and necessary, especially in today's world of progressive climate change. It would be equally important to include the achievements of humanities and social sciences



within the natural environment research, because, I hope, the humanistic thought may provide a new perspective on the given problem. It is not only about inventing a technology or discovering a previously unknown object, but rather about stabilizing certain rules of dealing with a given "object" in the society - about rooting social knowledge, cognizable and assimilable for the majority, rules of behavior and division of responsibilities, a way of talking about it, not as something "external" but as something known and shared. Otherwise, we are faced with the construction of a kind of myths driven by the need to know how a technology works, and with them an increase in the danger of losing control of the transforming narrative, perhaps going in a degenerate direction, as was the case with the described escalation of fear in the context of the perceived but unrecognized threat of radioactivity.

Thus, since we agree in the scientific field on the necessity of using nuclear power plants to produce electricity, in the context of progressive climate change caused by excessive burning of fossils, we should also consider the study and formation of social perception of such technology, *inter alia*, in the context of historical discourses for example rooted in works of pop culture, which still have a real impact on the perception of both this technology and the scale of possible danger, which I wanted to present in this article.

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## Literature

- [1] IPCC (Intergovernmental Panel on Climate Change), *Global Warming of 1.5°C, Special Report*, 2018.
- [2] M. T. Lee, E. M. Markowitz, P. D. Howe, C. Y. Ko, A. A. Leiserowitz, *Predictors of public climate change awareness and risk perception around the world*, "Nature Climate Change", (2015), Vol. 5, 1014–1020.
- [3] M. Budziszewska, A. Kardaś, Z. Bohdanowicz, *Klimatyczne ABC*, Warszawa: Wydawnictwo Uniwersytetu Warszawskiego 2021.
- [4] Article about plans to build a nuclear power plant in Poland <https://www.energetyka24.com/w-tym-roku-startuje-polska-elektrownia-jadrowa-przynajmniej-formalnie-komentarz> [16.07.2021].
- [5] Article by Marcin Popkiewicz <https://wysokienapiecie.pl/36404-oze-czy-atom-transformacja-dla-opornych/> [16.07.2021].
- [6] Data on the use of nuclear power in the European Union countries <https://smoglab.pl/w-unii-europejskiej-wciaz-duzo-wiecej-energii-elektrycznej-pochodzi-z-atому-niz-laczenie-z-wiatru-i-slonca/> [16.07.2021].
- [7] Report on the use of nuclear power in the European Union countries

- <https://www.rockstone-research.com/index.php/en/markets-commodities/624-Europes-Electricity-Production-by-Country-and-Fuel-Type> [16.07.2021].
- [8] Polemic by Adam Błażowski with the article by Marcin Popkiewicz  
<https://oko.press/oze-bez-atomu-to-wiara-w-czary-polemika/> [16.07.2021].
- [9] B. Brook, C. Bradshaw, *Key role for nuclear energy in global biodiversity conservation*, "Conservation Biology", (2014) Vol. 29(3), 702–712.
- [10] Letter from climate scientists in biodiversity conservation  
<https://bravenewclimate.com/2014/12/15/an-open-letter-to-environmentalists-on-nuclear-energy/> [16.07.2021].
- [11] Article about the position of the Polish Academy of Sciences on the nuclear power plant  
<https://oko.press/eksperci-pan-w-polsce-potrzebne-beda-elektrownie-jadrowe-i-trzeba-do-tego-przekonac-spoleczenstwo/> [16.07.2021].
- [12] Interview with Professor Szymon Malinowski  
<https://oko.press/prof-malinowski-bez-energii-jadrowej-nie-damy-rady-odejsc-od-wegla-wywiad/> [16.07.2021].
- [13] N. Shute, *Ostatni brzeg*, tłum. Z. Kierszys, Warszawa: Książka i Wiedza 1979.  
A. Weisman, *Świat bez nas*, tłum. J. Mrzigod, Warszawa: Wydawnictwo C.K.A. 2007.
- [14] D. Chakrabarty, *Klimat historii*, „Teksty Drugie”, tłum. M. Szcześniak, (2015) Vol. 5, 168-199.
- [15] "Duck and cover us civil defense" USA 1951  
<https://www.youtube.com/watch?v=BFT8hLjHtuE> [16.07.2021].
- [16] "Survival Under Atomic Attack" USA 1951  
<https://www.youtube.com/watch?v=4C2yOQH8kQs> [16.07.2021].
- [17] "Protect & Survive" USA 1970  
<https://www.youtube.com/watch?v=m6U9T3R3EQg> [16.07.2021].
- [18] Żukowski D., *O bombie, opadzie i radioaktywnych lucky strike'ach*, „Barbarzyńca”, (2008), Vol. 3, 72-80.
- [19] "Medical Aspects of Nuclear Radiation" USA 1950  
[https://www.youtube.com/watch?v=\\_iEuy7CVxV8](https://www.youtube.com/watch?v=_iEuy7CVxV8) [16.07.2021].
- [20] Ingold T., *Kultura i postrzeganie środowiska*, tłum. G. Pożarlik, w: *Badanie kultury. Elementy teorii antropologicznej*, M. Kempny, E. Nowicka (red.), Warszawa: PWN 2003.
- [21] Haraway D., *Manifest gatunków stowarzyszonych*, tłum. J. Bednarek, w: *Teorie wywrotowe. Antologia przekładów*, A. Gajewska (red.), Poznań: Wydawnictwo Poznańskie 2013.

## **MOTIVATION AND ITS ROLE IN THE LEARNING PROCESS**

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### **Abstract:**

Motivation means all the mechanisms that are responsible for triggering, sustaining, and stopping behaviors. Numerous psychological studies of students' mental barriers have become the basis for identifying factors that may significantly affect the course of the teaching process. The most important ones include: shame related to participating in a situation that the learner assesses as artificial, shame experienced in connection with being assessed and observed, fear of failure, wrong attitude and misunderstanding of the learning process, ignorance about the practical application of acquired skills, strong conformism of the individual, schematicism of perception and rigidity of thinking, the level of self-esteem and self-control. These conditions should be identified earlier in employees, pupils or students. A task can be viewed in two ways: as the result that a person wants to achieve or as an image of a goal that someone is setting on the way to achieving a certain result.

### **Keywords:**

*motivation, learning, determination, result, barriers*

Since the 1970s, many researchers have studied the concept of motivation, and the authors famous for its fullest definition are Richard Ryan and Edward Deci, who define self-motivation as an innate tendency to seek newness and challenges, develop and improve one's own abilities, explore and learn" [1].

Motivation means all the mechanisms that are responsible for triggering, sustaining, and stopping behaviors. Man is unable to perform any action when motivation is lacking, as it is the driving force behind actions and work. Motivation is the process by which an individual focuses on achieving a specific result. It is mainly about meeting basic human needs, and then others. If a man has enough of everything, he needs a special motivation to carry out the actions he has planned. Then he sets himself specific tasks to be accomplished, and at the same time forces himself to make sacrifices and make a specific effort.

Various fields of science deal with the phenomenon of motivation: psychology, sociology, sociology, and health medicine. There are many psychological concepts of motivation to achieve success. They were dealt with, among others, by Henry Murray, David McClelland, John Atkinson, Bernard Weiner, and Heinz Heckhausen. Heinz Schuler and Michael Prochaski are the authors of the onion model of achievement motivation. Their research identified three types of needs: competence,

relationship with others, and autonomy. Competence is another variable in the motivation process, and its presence is the driving force behind achieving goals and undertaking difficult tasks. This process must take place by developing your internal autonomy. The most important feature of autonomic behavior, which is behavior that arises without the involvement of external factors. In the theory of self-determination, it is emphasized that people have an innate tendency to be interested in unknown stimuli, to take up challenges, and during this type of activities they develop their competence. Man is by nature a weak creature, and even when he sets himself the goal of carrying out certain undertakings, resolutions can be fragile and fall apart. Here the question arises whether to punish or reward for specific actions and how to do it skillfully. Behavior that reward us for behavior that makes us happy can in itself result in an unexpected twist, i.e. a lack of motivation.

The reason for this is the fact that rewards are perceived as limiting the individual's autonomy. Therefore, in order to avoid this, it is necessary to increase her sense of it, which causes a proportional increase in internal motivation and internal empowerment of the sense of control. It may be a belief about one's own agency, about fulfilling a mission, about influencing the course of events.

„Motivation means dynamic cumulative variables to stimulate a given person, which direct, coordinate, strengthen, bring to an end and evaluate cognitive and motor processes, thanks to which initial wishes and desires are selected, prioritized, prepared for implementation and realized" [2].

Motivation is a process that arises in a person as a result of external and internal conditioning. It is a state of mental and physical readiness to perform an action. You can submit to it depending on the conditioning of your thought and cognitive processes. Motivation as a strong accumulation of emotions causes a change in behavior and thought processes. This phenomenon is investigated by scientists and described in many research papers, subjecting people of different ages to surveys, especially school students and corporate employees. Why is that so? Motivation applies to every person and every sphere of life. It is a process that takes place at work, at school or during everyday activities. It is not possible to say whether he or she will react positively to the motivation process at a given moment, and the motivational determinants are very diverse. However, it can be said that under the influence of certain stimuli one reacts in an appropriate way. The process itself is very difficult and consists of many factors. The tasks that are recommended to the motivated person at some stage may turn out to be either too difficult or too easy. Then, negative emotions appear, such as fear or a decrease in self-confidence, and in the case of too easy ones - a feeling of undervaluation, low self-esteem. The motivational process is supposed to influence the individual in such a way that he can work intensively, develop and be active. It is a force that builds up internally and becomes the driving force for action. There are many situations and life activities that you do not need to motivate yourself to perform, because they are completely natural. Some, however, require already conscious effort and commitment. Commitment is a factor that fosters a long-term relationship with your employer. Consequently, it leads to a higher level of service or higher quality of products as well as higher labor productivity. These factors contribute to generating profits for the company.

*According to Kevin Kruse and Rudy Karsen, authors of the book WE: How to Increase Performance and Profits Through Full Engagement, the three most important factors influencing employee engagement are:*

- development – employees need to feel that they are developing and learning new things,
- respect – for employees, their ideas and their work,

– trust – trust in managers and a sense of security as to the professional future.

“Motivation is the source and driver of behavior. It is a process in the human consciousness (or rather subconsciousness) that results in the desire to do something. This willingness is referred to as the motive, wake-up call or, in other words, motivational tension. A motive appears when there is awareness of some unsatisfied need and is expressed in the readiness to take action to satisfy it” [3]. The vast majority of problems with motivation arise from the fact that its meaning is not understood. We need to understand emotions and their types to see if they influence our motivation. Sometimes it will be motivated by fear, other times by longing and guilt, but each time the aspirations that arose under the influence of motivation will be an individual vision of further action. Motivation is also a process that stimulates the formation of abilities with which a person is born or not, and sometimes it is possible to shape them over the years. Abilities play an important role in a person's life, they determine his or her successes or failures, successes and satisfaction with the work performed, the effects of a student's activities at school, the ability to organize learning, work and leisure. By the term "ability" B. Hornowski understands an individual trait of a person's personality, which cannot be reduced to developed habits, but thanks to which various inclinations, abilities and skills can be shaped. Observing the activities of children and adolescents in various situations, one can notice individual features that manifest themselves in various mental processes. For example, in the speed and efficiency of thinking, the formation of original ideas, motor skills, language skills, in literary, mathematical, artistic, musical and other activities. Abilities are skills that are born with, and they definitely help in functioning and, moreover, in shaping the personality and vision of oneself. In order to develop, polish and nurture the abilities, they need to be properly stimulated by motivating and inspiring to further action. A stimulated person is able to be more active, develop skills and engage more energy, he looks for various solutions. In the learning process, motivation is a significant factor in determining the result of work, but not only in this process. By using a specific type of incentive in the form of rewards and punishments, employees will notice an increased interest in the activities in question. Many psychologists consider motivation to be the most important factor in effective learning. Hull takes the view that motives play an important role in this process. Hilgard, on the other hand, believes that grasping motives is more necessary than understanding the learning process. Knowing the motives of learning, you can control their influence on the learning process, transform them and influence the formation of the desired. Murray argues that the motives of an individual's behavior consist of a drive, which is one of the internal factors that mobilize the individual to act, and the pursuit of a specific goal or winning a reward [3]. When a certain goal is achieved, the effect of the internal factor weakens and the motive ceases to guide the behavior of the impulse.

The decisions that are made play an important role in the motivation process. They can affect your entire life. Decisions are often made under the influence of strong emotions, stress, some of them are thoughtful and decisive. Lack of motivation often means making decisions that go against your beliefs. Motivation is the result of decisions made. External motivation focused on material benefits. Very often, tasks are performed with the expectation of being paid or praised. Internal motivation results from the need to perform some action that in itself gives a person joy and satisfaction. The research of psychologists shows that both types of motivation make a person more and more involved in performing a given activity and, together with achieving a specific goal, he would like to do it better or faster, or receive more remuneration. Emmanuel Gobillot drew attention

to the negative effects of external motivation and explains that focusing on economic incentives reduces a person's sense of morality and duty towards people.

There are many definitions of motivation. Many researchers can be mentioned here, dealing with the motivation of students, employees or individual social groups, i.e. :

One of the definitions says: "motivation consists in influencing employees by various forms and means so that their behavior is consistent with the will of the driver, so that they are aimed at the accomplishment of the tasks set before him" [3].

Yet another definition is formulated by L.R. Bittel, who believes that "motivation is the inner state of mind and body, dreams, wishes, needs and what a person is driven by, which stimulates a person to take action" [3].

Motivation may be innate, but this is not always the case. Mostly it is conscious energy that is in control. The failures that people face every day do not depend on whether they are well or badly motivated. Whether he will be successful or not depends on his inner determination, willpower and effort, or the work he puts in to achieve the planned goal.

On the basis of research, it can be concluded that many times a person attributes success to those factors over which he has theoretical control. In the process of motivating to a specific action, a lot depends on the self-esteem of the individual, which allows for a critical image of the person and relating to it. Human abilities are an acquired feature, but depending on many factors, they are shaped in a particular way. Poor motivation can slow down the capacity building process. The strength and importance of children's motivation in learning increases if external stimuli are closely related to internal motives, then they complement and strengthen each other. It should be remembered of the psychological aspects of motivation. In the process of teaching or acquiring new skills, it is known that the path to improving skills is very bumpy. The moment the results do not come so quickly, a visible barrier begins to emerge. In the case of teaching foreign languages, we encounter barriers that limit students in presenting their language competences. Since there is a strong relationship between linguistic competences and creative (e.g. literary) abilities, this limitation caused by mental attitude may also impair these functions. Numerous psychological studies of students' mental barriers have become the basis for identifying factors that may significantly affect the course of the foreign language teaching process. The most important ones include: shame related to participating in a situation that the learner assesses as artificial, shame experienced due to being judged and observed by others, negative emotional tension related to the expected failure, wrong attitude and misunderstanding of the process of learning a foreign language, ignorance on the practical application of acquired skills, strong conformism of the individual, schema of perception and rigidity of thinking, level of self-esteem and self-control, lack of linguistic intuition or fear of using it..

It is worth to clarify, what exactly is meant by the concept of motive and motivation to learn. The mechanisms that stimulate the student to learn at school and organize the means to overcome difficulties are the learning motives which determine the learning outcomes as much as the teaching methods. The basic concept of the psychology of motivation is the concept of a motive, defined as a factor that activates an individual's goal-oriented activity, and in a specifically human sense it is the conscious reason of human activity. Motivation, on the other hand, is a set of factors arising under the influence of internal states or external situations that trigger conscious action. Since most activities undertaken by an individual are the result of the activities of various motives, these terms are used



interchangeably. Motivation is a theoretical construct that explains the triggering of behavior, its orientation and duration - especially consciously directed at a goal. Motivation manifests itself in behavior and can only be observed in this dimension [4].

Motivation, in other words, is getting someone to do something they really want. It would be much easier to persuade someone to do something that the other person wants, but it would not be a motivating act only manipulative. Therefore, this line is also very thin. Parents and teachers can increase children's development mindsets by praising them for their effort and persistence (not intelligence), telling them a variety of success stories from famous and well-respected individuals who emphasize hard work and a passion for cognition. It is also important to make children aware of the functions of the brain as a learning tool [5].

Research on working under the supervision of a supervisor has shown that when the boss respects the opinions of employees, leaves them the opportunity to make decisions, consults ideas with them, and uses rewards and punishments as information, employees have high internal motivation. On the other hand, if the boss gives categorical orders, sets specific deadlines for carrying out tasks, and uses punishments and rewards to elicit a reaction, employees have low internal motivation. It is related to the sense of control, which is low with high restrictions on the part of the boss, which adversely affects internal motivation. Motivation is a complex process, it can be divided into, among others, external and internal. External motivation is where the main motive for action is the system of punishments and rewards. The internal one is a bit more complicated and depends on the operation of the unit. The reward for us should be general satisfaction and joy. Then these activities can be called passion.

Motivation will heighten your will to succeed. Our achievements will therefore be the product of hard work, not innate intelligence or external factors. Although in many cases such factors play a key role in the achievement of an individual. In the research on the internal motivation of students, a uniform thought pattern was found - I am intelligent, I do not have to make any effort, but if I do not make an effort, I make poor progress [6]. Nowadays, the school teaches creativity and creative thinking on the one hand, and forces knowledge, enforces it on the other. Now only people who are directly focused on acquiring knowledge can count on special brain activity. Teachers, educators and parents play a very important role here, and they should motivate their children and pupils to engage. Work, effort, and willingness to act should be praised first, not intelligence that we know is a personality product. It is best to listen to stories about well-known and liked, who achieved success, and to use them as an example to engage your thoughts and set yourself up for specific actions. High results have never been achieved without effort. Effort is the basic variable that characterizes the pursuit of a goal.

Man is a very demanding being. If he reaches a goal, he would like to get another one. It is rarely satisfied for long. Man all his life wants something and strives for something. It is his motive, energy to act and gives meaning to life. The motives of each individual are different. Usually simple, e.g. a desire to get a job, finish school, get a certificate. There are also smaller desires to these desires: the desire to try a good cake, drink coffee, walk in the park. Satisfying these desires must be realized in a certain order. Satisfying one factor causes the desire to satisfy another. Note that you consciously pursue what you can achieve. John Dewey and Edward Thorndike had an effect on an important aspect of motivation, i.e. the longing for what could possibly be achieved [7].

Maslow, in his book, compiled a list of needs that a person satisfies and will strive to satisfy them: physiological needs, security, belonging and love, respect, self-realization, the desire for knowledge and understanding, and aesthetic needs. As these needs are satisfied, a person will need to meet new needs and, seeing that it succeeds, will be motivated to achieve their goals. Everyone meets the needs that are realizable or most likely. This does not mean that you do not think or want something that is unattainable or impossible to achieve, e.g. due to a lack of financial resources [7].

Motivation is very important to the efficiency of any job. The task-driven goals of an organization can be described from three perspectives: orientation (goal, intention, result), intensity (pace, workload, intensity) and structure. These conditions should be recognized earlier in employees, pupils or students. A task can be viewed in two ways: as the result that a person wants to achieve or as an image of a goal that someone is setting on the way to achieving a certain result.

Each person has specific needs and based on them, these people can be motivated. Professional activity and commitment will, of course, have a positive impact on the intended results, especially if the work is related to personal development. An active person who wants to develop professionally will certainly need affiliation and power. She is a self-confident person, therefore she needs motivation in order to climb higher and higher levels of development. When talking about needs, one should refer to Maslow's hierarchy of needs, where the need for self-realization and fulfillment is at the highest level, but after satisfying basic needs, e.g. physiological, as mentioned earlier. Motivation through values is still the most popular. As long as money rules the world, everyone is trying to get it. Good pay depending on the effectiveness and efficiency of work is a motivating force. But the value of money is one thing, and we can also mention recognition of merit and a sense of belonging to a team. Motivating through values strengthens commitment, enables personal development, and supports creative behavior. The determining factor for work is the enormous importance of the award. In his theory of expectations, Victor Vroom argues that motivation is a decision-making process determined by personality factors and the environment. The main assumption is that "an employee will feel motivated if he sees getting an adequate reward." An important element in the motivation process is motivating to work by setting goals. Edwin Locke's theory assumes that the most important human motivation in the environment is to pursue a specific goal. In order to achieve this goal, such a person should be provided with appropriate working conditions, in a school or other work institution. That is why ambitious and clearly defined and precise tasks are motivating. In the absence of orders or unclear tasks, motivation is weak. In the theory of goal setting, it is worth emphasizing the employee's individual commitment, i.e. his determination in achieving goals. The involvement of a subordinate is influenced by external factors, e.g. power, support from colleagues, participation in planning goals - external factors, and the expectation of success, self-rewarding, personality factors, the need for achievements, perseverance, competitive attitude and offensiveness, as well as situational factors influencing commitment. The creator of social learning, Bandura, believed that achievement feedback is needed to maintain motivation at a high level. The strongest motivation is when clear goals are set. Goals set by oneself motivate more than those set by others. A man, knowing his strengths, should optimally set a goal for himself, adapt to his abilities.

## Literature

- [1] Grabowska, *Rozważania o jakości programu edukacyjnego*, Warszawa 2018
- [2] Michońska-Stadnik, *Nowe spojrzenie na motywację w dydaktyce języków obcych*, Wydawnictwo Wyższej Szkoły Filologicznej we Wrocławiu, Wrocław 2008
- [3] Z. Putkiewicz, *Uczenie się i nauczanie*, Warszawa 1973
- [4] PTN, *Specyfika nauczania/uczenia się języków obcych*, Lublin 2005
- [5] K. Kruszewski, *Sztuka nauczania. Czynności nauczyciela*, PWN Warszawa 1998
- [6] M. Marcinkowska-Bachlińska, *Psychologiczne czynniki wpływające na poziom motywacji do nauki języka obcego*, Lublin 2010
- [7] A. Maslow, *Motywacja i osobowość*, Warszawa 2006

## **EVIDENCE PROCEEDINGS UNDER THE AMENDMENT TO THE CODE OF CIVIL PROCEDURE**

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### **Abstract:**

Referring to the topics discussed during the conference, in my study I pay special attention to the issues of changes implemented to the KPC in the field of provisions on evidence and evidence proceedings. Concerning, *inter alia*, implementation of a new procedural category, i.e. facts about which information is commonly known, comprehensive regulation of the grounds for omitting evidence, the content of the evidence order and the appearance of a person designated by the party. Moreover, I analyse changes in the scope of individual means of evidence, in particular with regard to documentary evidence, evidence from witnesses and evidence from expert opinions. It is worth emphasizing that the changes implemented to KPC by the 2019 amendment have been commented differently in the legal community, which is why the analysis of changes in the evidentiary proceedings still seem to be interesting and worth attention.

### **Keywords:**

*evidence, evidence proceeding, civil procedure*

### **Introduction**

The issue of evidence proceedings is of great importance, both for the parties and the court, as it has a significant impact on the content of the resolution in the case. Undoubtedly, after November 7, 2019 [1], when the vast majority of the amendment to the Code of Civil Procedure [2] entered into force, hereinafter referred to as the KPC, via which the legislator implemented a number of changes to the civil procedure, including to a large extent evidentiary proceedings, which significantly changed the institution of evidences and in result examining the evidences in civil proceedings.

Fundamental changes in the evidence proceedings regard submitting statements and evidence, formulating evidence conclusions, introducing a new procedural evidence category, i.e. facts that are known, escalating the activity of the party and attorneys in examining evidences, in the scope of documentary evidence, evidence from witnesses and expert opinions, the use of extrajudicial opinions, and also introducing the possibility of concluding an evidence agreement to the proceedings in business cases.

## **Object and evaluation of evidences**

In terms of the provisions on evidence, there was a change of art. 228 § 1 of the Civil Procedure Code by adding that the facts that are known (notorious facts) are taken into consideration by the court even without reference to them by the parties. Transfer, in the slightly changed wording of the existing art. 213 § 1 of the Code of Civil Procedure from the part concerning the course of the hearing to the subject and evaluation of evidence, undoubtedly should be assessed as the legislator's correct action [3].

However, the key change is the addition of a new category of facts, i.e. facts that are known. Thus, in the current wording of Art. 228 of the Civil Procedure Code indicates three categories of facts that do not require evidence: facts commonly known, facts known ex officio to the court and newly introduced facts about which information is generally available.

Commonly known facts, or notorious facts, are "circumstances, events, actions or conditions that should be known to every reasonable and experienced resident of the town where the court is located. Historical and political events, natural phenomena, economic processes or events normally and simply occurring in a specific place and time are considered commonly known "[4]. Facts known to the court ex officio - in its current wording officially known to the court - should be considered facts which the court came into contact with in connection with the performance of official court activities - when examining another case [5].

The second separate new category - facts about which information is generally available includes information obtained from the Internet, what as far has not yet regulated by the KPC. It should be noted that this category includes only information having the attribute of "universal availability"; i.e. when the information can be obtained by any person, without the need for any specific action to that end [6]. Thus, facts that would require registration, logging in or signing up to a specific group should be excluded, as well as facts the access to which would require the payment of an appropriate fee [7]. Moreover, it should be highlighted that the legal status quo has extended the court's obligation to draw the parties' attention both to the facts known to the court ex officio, as well as to the facts about which information is publicly available, in order to provide the party with an opportunity to respond to this information.

## **Evidence proceeding**

An important novum is the specification of the requirements of the content of the application for the evidence examination. Introduced by the amendment to Art. 235(1) KPC obliges the party to mark the evidence in a way that allows it to be examined and to list the facts to be demonstrated by that evidence, specifying the necessary elements of each evidence application. When a party fails to meet the above requirements (after prior request to the party for correction of formal defects) in accordance with Art. 235(2) § 1 point 6 of the Code of Civil Procedure - the court may disregard such an evidence request. In the opinion of K. Knoppek, the appropriate moment to fill in the gaps in evidence applications is a pre-trial hearing, the effect of which - in the absence of settlement of the case - is the preparation of a hearing plan with all the evidence written out [7]. This regulation is applicable both

to the evidence motions formulated in the pleading, as well as those formulated orally during the hearing, and also at the institution of the pre-trial hearing introduced to the KPC [8].

This regulation is a reflection of the hitherto art. 258 KPC - repealed by the Act of 4 July 2019 due to the introduction of the above regulation - which established the requirement of precise identification of the facts, but only for evidence based on witness testimonies. Thus, in the current legal status, it is not only good procedural practice (not counting evidence from witness testimonies), but a necessary condition to precisely formulate facts to prove the requested evidence.

Undoubtedly, the implementation of this regulation by the legislator was aimed at eliminating general, often enigmatic, formulation of evidence conclusions [9]. Thus, this amendment affects the negative form of a court decision regarding the application for the evidence examination, which has not been regulated so far in KPC[7]. There is no doubt that the introduction of Art. 235(1) of KPC helps to overcome the bad practice of invoking evidence conclusions "on a circumstance", instead of indicating specific facts that a party wants to prove with given evidence [10].

It is necessary to indicate the Art. 235(2) of KPC, which was added as part of the amendment - which systematizes the circumstances justifying the refusal to examine evidence, undoubtedly creating an open catalog of premises for the omission of evidence. By introducing a given regulation, the legislator reflected the provision of Art. 170 of the Code of Criminal Procedure [11], adjusting it accordingly to the specifics of civil procedure. Thus, the court ignores the evidence mentioned in Art. 235(2) of KPC, which complements the existing legal prohibitions on evidence, incl. such as: art. 259, 259<sup>1</sup>, 260 and 261 of KPC.

However, the introduced regulation raises some doubts as to the completely optional form of the premises for the omission of evidence, especially at this point it is necessary to highlight Art. 235(2) § 1 point 1 concerning the omission of evidence "examination is excluded by a provision of the Code" and point 4 of the evidence "impossible to examine", because in the indicated cases the obligatory form would undoubtedly be far more appropriate [7].

A fundamental change is introduced by § 2 of the discussed regulation with regard to the necessity for the court to issue a negative evidentiary decision in the event that evidence is omitted. The legislator clearly presents one of the views indicated so far in the judiciary, stating that, apart from evidence, the court issues a decision indicating the legal basis for this decision. It can be said that the present one constitutes a certain facilitation in the possible construction of the appeal charges.

Referring to the introduced changes, a normative distinction between an evidence provision is clearly visible, between the negative aspect, i.e. the decision to omit evidence, and the positive aspect - the decision to admit evidence [8]. The linguistic modification in Art. 236 of KPC shall be considered as a valuable, because the essence of an evidence decision as a formal decision is "addition of evidence" not the examination itself, which in fact is only a factual act [12]. It should be noted here that if a plan for a hearing is prepared in a case, pursuant to Art. 205(9) § 1 of KPC contains a decision as to the evidence motions, thus replacing the evidence decision [3].

In a civil trial, a complete novum is the imposition on the party requesting a witness, expert or other person to be summoned to the trial - an obligation to make efforts for that person to appear on the date of the trial, and moreover to notify such person of the time, place and necessity to appear. Thus, added by the amendment to Art. 242(1) of KPC creates a specific dualism of summoning witnesses and experts for the date of the hearing, because in the current legal status, both the court



(by issuing the summons) and the party itself notifies about the time and place of such person's appearance [9].

It should be added that in the event of failure to comply with this obligation, this regulation does not contain any formal sanction. However, a given regulation undoubtedly activates the parties to the trial and shapes them awareness of joint responsibility for the efficient course of the proceedings [10]. It is worth noting that a given regulation was generally positively received by the legal community. Reasonable doubts in the doctrine are raised in relation to the contact between the party and an expert who should be completely impartial while preparing the opinion [13]; and also the failure to introduce a mandatory instruction to the parties to make efforts in the context of the appearance of the summoned persons [7]. Nevertheless, the aim of the regulation should be assessed positively, as a given regulation facilitates examination of evidence, which should "accelerate" the procedure [3].

Moreover, Art. 242(2) of KPC regulates the institution of taking a promise in the course of civil proceedings. The legislator decided that the current regulation of the promise is fragmentary and insufficient, and therefore requires changes [10]. Pursuant to the new provision, in the current legal status, the promise of a person appearing before a court is only received by the court or a designated judge, and not by the presiding judge as before. Moreover, such a quality was also clearly deprived of a court referendary. As a consequence, Art. 270 of KPC was repealed, and the wording of Art. 266 § 3 of KPC was adjusted to this institution.

### **Significant changes with regard to particular evidences**

Undoubtedly, the key changes took place in the field of documentary evidence, because, added by the amendment Art. 243(2) of KPC introduces an exception to the general rule, according to which the court decides to admit evidence by issuing a decision. The new regulation explicitly states that if the documents are in the case files or are attached to them, they constitute evidence in the case, without issuing a separate decision. Thus, clearly "the legal nature of this evidence has changed, as the admission of documentary evidence is effected by operation of law by the mere filing of the document in the case file" [7].

Nevertheless, when the court omits the evidence from such a document, it is obliged to issue an appropriate decision in this regard. It should be noted that this decision is not subject to appeal, therefore, in order to provide a party with an instance control at the stage of possible appeal proceedings, party should submit an objection to the protocol under Art. 162 of KPC, and then pursuant to Art. 380 of KPC on appeal, apply for recognition of a given decision by the appellate court [9].

The purpose of this regulation was undoubtedly to simplify the admission of documentary evidence. However, it should be borne in mind that the mere admission and evidence examination does not guarantee that a given document will be taken into account by the court during its judgment [7]. In the light of the introduced change, at the stage of taking documentary evidence, there was a significant reduction in the activity of the court, as pursuant to Art. 235(2) of KPC, it only takes into account whether there are grounds for omitting evidence in a given case [13].

Moving on to changes in the scope of evidence from witnesses' testimonies, first of all, it is necessary to point to the implementation of Art. 271(1) of KPC - which is an important novum in civil proceedings. The above regulation allows witness to testify in writing, if the court so decides. Until now, such a procedure was provided for only by the European Small Claims Procedure - Art. 505(25) § 1 of KPC, which in the current legal status was repealed with the implementation of this regulation.

The very idea of establishing the possibility for witnesses to testify in writing should be assessed positively, however, the wording of the provision raises many doubts in the doctrine [14]. In critical views expressed in the literature, particular attention was paid to the lack of mechanisms allowing to assess the credibility of these testimonies, and also to the lack of tools that would allow checking the witness' independence during the preparation of the testimony, and what is more, the lack of interference by third parties in this testimony. Pursuant to Art. 233 § 1 of KPC, this may undoubtedly have a negative impact on the assessment of the entirety of the evidence [15]. Thus, the specified imperfections of a given regulation may result in negligible probative value of such testimonies, and in the end make the evidence useless, despite the fact that the witness himself may have the key information to resolve a case [14].

Another new regulation is the implementation of Art. 272(1) to KPC -, that created the possibility for the court to use the assistance of an expert doctor or psychologist in assessing the ability to perceive or communicate the observations of a witness. Under the current legal status, KPC - unlike the criminal procedure from which the new regulation was certainly taken - did not explicitly provided such a possibility, moreover, that raised many doubts in the doctrine.

It should be noted that the institution of hearing a witness with the participation of an expert is only possible when the court has doubts related to the witness ability to perceive or communicate. As the provision states, the witness cannot oppose it. It is true that this undoubtedly constitutes a restriction of the witness's right to privacy, however, due to the fact that the expert's participation is limited to observing the behavior and manner of speaking of the witness, without the possibility of conducting further research, it should be considered that it is proportionate, adequate to the purpose of the legislator wanted to achieve by removing, doubts as to the assessment of the capacity of a person who was to be a witness with the help of a specialist [16].

The amendment also included expert evidence, by implementing Art. 278(1) to KPC, which allowed the court to use evidence from an opinion prepared at the request of a public authority in other proceedings. The term "public authority bodies" should undoubtedly be understood as bodies within the meaning of Art. 244 of KPC, so by way of example these will be: national and local government bodies and state administration offices, tax administration offices, public prosecutor's offices, as well as professional self-government bodies. As the above regulation belongs to the general provisions of evidence proceedings, it is applicable in every civil case [17]. The aim of introducing this regulation is certainly supported by the postulate of improvement of civil proceedings efficiency, and what is more, not creating unnecessary costs in the process by generating repeatedly identical opinions. Moreover, the acceleration of the proceedings is certainly enhanced by the § 4 Art. 290 of KPC, which to some extent breaks the principle of collegiality of the opinion of the institute, introducing the possibility of supplementing, explaining and submitting an additional opinion.

## **Evidence contract**

Another novum is the evidence contract, which in accordance with Art. 458 (9) § 1 of KPC, allows the parties to exclude the possibility of using certain evidence in the proceedings in a dispute resulting from a contractual relationship. This regulation covers only separate proceedings in commercial cases, thus the parties should be understood as professional entities, i.e. entrepreneurs. The source of the evidence limitation is a specific, contractual legal relationship, which must be concluded by the parties in writing or orally before the court, otherwise null and void. The evidence contract is a type of mixed procedural agreement, as it contains both substantive and procedural elements [18].

This institution, so far unknown to Polish civil proceedings, may, however, raise many doubts. The aim for implementation this regulation was certainly the faster and simpler examination of economic cases [10], but nevertheless the "evidence contract" actually leads to certain procedural complications. They are related in particular to contesting the validity of the concluded contract by one of the parties, as well as questioning the fact of its conclusion [19]. Thus, the subject of court examination in commercial cases may often include the provisions of the agreement or the issues of defects in declarations of will, which undoubtedly does not lead to faster examination of the case. Moreover, another question that raises doubts is the imposition of stricter requirements and procedural rigors on the parties to these proceedings than in other civil cases. The consequences of the above may affect mainly small and medium-sized enterprises. According to R. Kulski, providing the parties with a professional attorney in this type of cases, ie establishing a compulsory attorney-at-law, could effectively solve this problem [20].

## **Summary**

Considering the above, it is certainly to be concluded that the amendment in implemented a number of changes in the evidentiary proceedings. Some of them were merely of an organizational nature, some constituted the views previously expressed in literature or jurisprudence, and eventually some of them actually changed the current shape of the evidence proceedings. It should be emphasized that this study presents only the most important changes introduced in the field of evidence law, at the same time pointing to noticeable problems of a practical nature.

However, attention should also be paid to the changes that undoubtedly affect the evidence proceedings, and which have not been included in this study. Thus, the most important changes in the examination procedure, affecting the evidence proceedings, include the implementation of the institution of preparatory sessions and the plan for the hearing, as well as the rules for issuing decisions, including evidence decisions in closed session. As A. Mendrek points out, while the admission of the issuance of evidence decisions at a closed session should be assessed positively, the current form of the plan for the trial (one element of which is the obligatory resolution of evidence) and the consequences of the hybrid nature of this institution should be assessed critically [21].

The carried out analysis of changes in this study leads to the conclusion that in some aspects the proceedings may actually be accelerated. In particular, the new institution of facts about which information is commonly known, as well as the regulation of the premises for the omission of

evidence and the content of the evidence order, may be of significant importance. Thus, the idea of introducing changes to the evidence proceedings should be assessed positively despite some comments.

## Literature

- [1] Ustawa o zmianie ustawy z dnia 4 lipca 2019 r., - Kodeks postępowania cywilnego oraz niektórych innych ustaw (OJ of 2019 r. item 469).
- [2] Ustawa z dnia 17 listopada 1964 r. - Kodeks postępowania cywilnego (OJ of 2020 r, item 1575 as amended).
- [3] M. Krakowiak, w: *Kodeks postępowania cywilnego. Tom I A. Komentarz. Art. 1-424<sup>12</sup>*, A. Góra-Błaszczkowska (red.), Warszawa 2020.
- [4] Wyrok SA w Warszawie z 20.09.2012 r., VI ACa 415/12.
- [5] Zieliński, K. Flaga-Gieruszyńska, *Postępowanie cywilne. Kompendium*, Warszawa 2020, p. 157.
- [6] M. Malczyk, *Komentarz do art. 228*, w: *Kodeks postępowania cywilnego. Koszty sądowe w sprawach cywilnych. Dochodzenie roszczeń w postępowaniu grupowym. Przepisy przejściowe. Komentarz do zmian. Tom I*, T. Zembruski (red.), Warszawa 2020, p. 586.
- [7] K. Knoppek, *Dowody i postępowanie dowodowe w sprawach cywilnych po nowelizacji Kodeksu postępowania cywilnego z 4.07.2019 r.*, Palestra 11-12/2019, p. 70, 72-74.
- [8] Budniak-Rogała, *Komentarz do art. 235(2)*, w: *Kodeks postępowania cywilnego. Koszty sądowe w sprawach cywilnych. Dochodzenie roszczeń w postępowaniu grupowym. Przepisy przejściowe. Komentarz do zmian. Tom I*, T. Zembruski (red.), Warszawa 2020, p. 589, 591.
- [9] S. Jaworski, *Kodeks postępowania cywilnego. Komentarz do zmian*, Warszawa 2019, p. 167, 171-174.
- [10] Uzasadnienie rządowego projektu ustawy - Kodeks postępowania cywilnego oraz niektórych innych ustaw, z dnia 8 stycznia 2019 r., Sejm VIII kadencji, druk sejmowy nr 3137, p. 54, 57, 106.
- [11] Ustawa z dnia 6 czerwca 1997 r. – Kodeks postępowania karnego (OJ of 2021, item 534 as amended).
- [12] G. Kamiński, *Zmiany w postępowaniu dowodowym w nowelizacji KPC*, 2019, n.ius.
- [13] K. Ziemiański, *Komentarz do art. 242(1)*, w: *Kodeks postępowania cywilnego. Koszty sądowe w sprawach cywilnych. Dochodzenie roszczeń w postępowaniu grupowym. Przepisy przejściowe. Komentarz do zmian. Tom I*, T. Zembruski (red.), Warszawa 2020, p. 622, 627.
- [14] M. Dziurda, *Dowód z zeznań świadka na piśmie*, Palestra 11-12/2019, p. 103.
- [15] M. Skibińska, *Komentarz do art. 271(1)* w: *Kodeks postępowania cywilnego. Koszty sądowe w sprawach cywilnych. Dochodzenie roszczeń w postępowaniu grupowym. Przepisy przejściowe. Komentarz do zmian. Tom I*, T. Zembruski (red.), Warszawa 2020, p. 632.
- [16] K. Flaga-Gieruszyńska, *Środki dowodowe i postępowanie dowodowe w nowelizacji Kodeksu postępowania cywilnego z 4.07.2019 r.*, Palestra, 11-12/2019, p. 96.

- [17] M. Cichorska, *Komentarz do art. 278(1)*, w: *Kodeks postępowania cywilnego. Koszty sądowe w sprawach cywilnych. Dochodzenie roszczeń w postępowaniu grupowym. Przepisy przejściowe. Komentarz do zmian. Tom I*, T. Zembruski (red.), Warszawa 2020, p. 651.
- [18] P. Feliga, *Sprawiedliwe załatwienie sprawy gospodarczej*, w: *Reforma czy kolejna nowelizacja? Uwagi na tle ustawy z 4.7.2019 r. zmieniającej KPC*, P. Rylski (red.), Warszawa 2020, p. 194.
- [19] M. Muliński, w: *Kodeks postępowania cywilnego. Tom I B. Komentarz. Art. 425-729*, A. Góra-Błaszczkowska (red.), Warszawa 2020.
- [20] R. Kulski, *Odrębności postępowania w sprawach gospodarczych*, MOP 2019, Vol. 21.
- [21] Mendrek, *Reforma prawa dowodowego w świetle nowelizacji z 4.7.2019 r.*, w: *Nowelizacja Kodeksu postępowania cywilnego z 4.7.2019 r. w praktyce*, K. Flaga-Gieruszyńska (red.), Warszawa 2020.

## LETTERS BY ZYGMUNT KRASIŃSKI AS AN EXAMPLE OF ROMANTIC EPISTOLOGRAPHY

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### **Abstract:**

The 19th century was a time of flourishing epistolography. It was then that letter underwent numerous transformations, both in terms of form and content. It was elevated to a literary genre while remaining a record of personal impressions and experiences. Letters are also, or perhaps even first of all, a valuable source of information about Romanticism, and Zygmunt Krasiński's correspondence is a perfect material for literary studies in this scope. He was not only a talented writer, but also a keen observer and a real child of his time, living according to Romantic ideas. The corpus of his letters is very large, rich and varied in content, partly due to the high number of addressees. Most of his correspondence is devoted to travels, love, philosophy of history and literature.

### **Keywords:**

*Romanticism, love, letters, travels, philosophy of history*

Zygmunt Krasiński is regarded as an outstanding representative of the Polish Romantic literature. Not without a reason, he is often described as the Third Bard, the other two being Mickiewicz and Słowacki. However, the memory of this great writer of the first half of the 19th century is slowly fading. His name is mentioned less and less, and if he is referred to in modern literature at all, it is usually in the context of *The Undivine Comedy* and *Irydion*. These are undoubtedly two very significant of his works, but they are not the only ones. He is also the author of a number of other writings that deserve a closer look, such as *Trzy myśli Ligenzy* (*Three Ideas of Ligenza*), *Przedświt* (*Before Dawn*), *Psalm przyszłości* (*Psalms of the Future*), *Agaj-Han* (*Aga Khan*) and *Władysław Herman i dwór jego* (*Władysław Herman and His Court*).

Moreover, or rather first of all, he wrote a considerable number of letters which are often disregarded or marginalised by literary scholars. It is worth mentioning that examining his correspondence is not an easy task, as Zbigniew Sudolski has pointed out: "This body of Polish literature is poorly known and clearly underappreciated. Disclosing large collections of letters requires a long period of time, necessary for political and family censorship to subside and for private owners to lose some of their passion for a particular collection, which makes them jealously guard its secrets or even ruthlessly destroy it. Apart from this individual destructive passion or censorship, history – in particular the tumultuous events of the 20th century – also substantially depleted our



Romantic epistolography, so that we can only grasp the basic trends and the greatest achievements of this important part of our national literature [1]”.

Meanwhile, it is precisely correspondence that reflects the character and atmosphere of the Romantic period. Krasiński's letters to individual addressees indicate that he was a real child of his time, unquestioningly, or even blindly, adhering to its ideas. Following in the footsteps of the exponents of Sentimentalism, he developed a style of letter writing that was worthy of his time, both in terms of form and content, which makes him an emblematic example of the Romantic letter mania.

The Romantic epistolography developed during the years 1817 – 1883 when letter was elevated to a literary genre by Mickiewicz, Słowacki, Krasiński, Norwid and others. They presented it in a whole new light and proved that correspondence could have more to do with literature than with official mail, since “the Romantic epistolography, created by private, individual senders was free of any limitations [2]”. The aesthetic function of letters came to the fore, and they frequently resembled literary narrative, both in form and content. It is noteworthy that senders and recipients were fully aware of this, as confirmed by Henry Reeve, Krasiński's youth friend: “Our correspondence contains a novel comparable to *The New Heloise*, and it is certainly even more authentic in matters of the heart and more moral in matters of our souls, since we are its authors [3]”. The principal aim of such letters was to reveal the writer's personality. Romanticism consolidated the theory of letter as a form of confession, though admittedly, such letters were already known in the Antiquity, as Stefania Skwarczyńska wrote in *Teoria listu* [4].

However, not every author intended to compose confession letters, so popular in the first half of the 19th century, e.g. Mickiewicz and Norwid were clearly reluctant to disclose their intimate thoughts and feelings, which does not mean that the Romantic element was absent in their correspondence. On the contrary – each of them developed his own, unique letter style that may have been far from personal elaborations, but nevertheless reflected the atmosphere of their time. The fact that both Mickiewicz and Norwid rejected the theory of the confession letter in favour of utilitarian content or questions of moral philosophy in no way diminished the value of their epistolography. They only demonstrated that there were various, distinctly individual ways of writing about their time.

Słowacki and Krasiński were not lacking in individuality, either, but the main purpose of their correspondence was to highlight their own personality and to describe their experiences and impressions. The tendency to self-analyse their feelings and to stylise their autobiographies runs through all their letters. Both of them used letters as a means to create their own image. One must bear in mind that the process of creating a personal legend depended to a large extent on the addressees. On many occasions, the authors had to take into account their tastes, which was by no means easy, e.g. Słowacki frequently complained about lack of understanding with his pen-friends. The only person he regularly corresponded with was his mother. This proves that the author of *Balladyna* was no expert in psychology. Maintaining correspondence required not just literary talent, but first of all knowledge of human nature. You had to write in such a way as to win the readers' trust and encourage them to confide in you in turn. Strengthening relations always had a positive influence on correspondence, as Krasiński knew very well from experience.

He had no difficulty in establishing correspondence with various addressees and he was able to attune to them in every respect. He knew what type of person they were and was well informed about their interests. He knew how to stir and maintain their curiosity. The content of his letters was adjusted to the recipients' tastes and traits of character. That is why Krasiński's correspondence is so varied, as Stanisław Tarnowski has noted: "Historical events and everyday experiences, a book he was engrossed in, an idea that was taking shape in his mind, literary works, people or things that made an impression on him – all this elaborately described and commented on took the form of a long letter to one of his friends. [...] his philosophical, political and religious ideas, his aesthetic tastes, his opinions on people, things and events, his feelings and tribulations – all this is reflected in his letters [5]".

As Tarnowski has observed, you can find just about everything in those letters, which is a characteristic feature of Romantic epistolography. According to its premises, any topic, however trivial, was just as legitimate in correspondence as philosophical reflections. The author was free to decide about the content, so that a single letter could include random or even contradictory motifs. This abundance of themes enabled the writer to show all possible aspects of his inner life, which in turn engaged the readers on a personal level and encouraged them to continue the correspondence.

This thematic diversity, few compositional restraints, Krasiński's knowledge of human nature, as well as his literary talent guaranteed the recipients' unflagging interest. The poet made sure that he was never short of correspondents and he always chose them very carefully. They represented various psychological types, which enabled him to fully reveal his own extremely complex personality. Styling one's biography in letters according to recipients' expectations required considerable talent, comparable to that of an actor assuming certain poses to match the needs and expectations of the audience. Krasiński truly was such an actor, wearing different masks as if he was performing on stage, and his life appears to have had more in common with a theatre play than with daily routine. Interestingly, as Zbigniew Sudolski has remarked, he was also the director and scriptwriter of this "play" [6]. If I were to say what this play is about, I would say it is a story about an eminent writer whose whole life was dedicated to a single idea – the idea of Romanticism. Krasiński did his best to follow the principles of his time, so that love and friendship were the feelings that gave his life meaning and formed the lens through which he perceived the world around him. Even so, his observations were very accurate. Krasiński was a keen and astute observer, trying to examine every phenomenon thoroughly, from its beginning to end. Afterwards, he wrote down his conclusions in a letter to a selected pen-friend.

Most of his correspondence is devoted to travels, love and philosophy of history. These questions were at the core of Romanticism and, in consequence, of Krasiński's biography. Examining them helps one understand the essence of Romanticism, but first of all, his letters are a perfect source of biographical information about the author himself. However, despite their personal nature, they do not always stick to the facts on account of his deliberate stylisation. Nevertheless, epistolography remains an irreplaceable source for biographical studies, as one can read in *Źródło do badań biograficznych* by Danuta Lalak and Aneta Ostaszewska [7].

This rich correspondence portrays an indefatigable traveller and patriot who was seeking salvation for his troubled country in philosophy of history while falling in love time and again with

no prospects for a happy relationship because Romantic love, in principle, had to be marked by pain and suffering.

Romanticism brought about a new type of traveller. What mattered was "Not just a description of things and places one visited, but also a presentation of the traveller [8]", his personality and inner life. For a true Romantic traveller, a journey was an end in itself. To travel meant to live, or rather to search for the meaning of life. Such travellers were usually described as: "lonely, lost, confused, hungry for knowledge and self-knowledge, striving for personal perfection and full of idealism, but uncertain about their fate, lost in the chasm of the universe or in the labyrinth of history, inquisitive researchers and adventurers, but also blindly and aimlessly walking in the fog [9]".

Their journeys took place on two parallel plains – the real and the metaphysical one. Travelling the length and breadth of foreign countries, they not only got to know new places, but also advanced spiritually, among other things, by chance encounters with other people who often gave direction to their further travels.

Kraśiński began his lifelong journeys in Geneva where he was studying. The city was chosen by his father, general Wincenty Kraśiński who believed it was "closer to Classicist order than Romantic dishevelment [10]". Unlike his son, the general was a supporter of the old regime in which reason triumphed over heart, not the other way round. The father's views did not prevent the son from developing his Romantic vision of the world from an early age, and his new acquaintances only bolstered it. During his stay in Geneva, he met, among others, Henry Reeve and Adam Mickiewicz. Judging by the letters that have been preserved, both of them were important figures in his life.

Kraśiński met Mickiewicz during his trip to the Alps which belonged to the most fashionable and awe-inspiring destinations among Romantic travellers. Before the Romantic era, mountains used to instil fear, and climbing them was a necessity rather than pleasure. Only "the 19th century brought the discovery of natural beauty for its own sake, regardless of its utilitarian value, e.g. in pre-Romantic times, the beauty of mountain peaks was not considered worth the effort and the life risk of climbing them. By contrast, for the Romantics, aesthetic impressions were a sufficient motivation for such expeditions and a sufficient reward for the sacrifices involved [11]". Both Mickiewicz and Kraśiński were greatly impressed by the beauty of the surrounding nature. In his letter to Reeve, Kraśiński recalled his climb of Mount Rigi as follows: "... an almost otherworldly, supernatural view, stretched before me [...]. An ocean of mist filled the entire space, and the top of Rigi appeared like an island, just like other mountain peaks. What an exquisite scenery it was! The mist was hanging motionless between us and the earth. We were above the clouds which looked like a thick surface of snow and ice. But when the sun shone, that surface began to unravel, and through its widening gaps you could glimpse a blue lake or, at another time, green meadows or woods. Finally, when the mist completely cleared up, we saw around us a wide, diverse and far country – fourteen lakes, thousands of mountains and Italy and Germany in the distance [12]".

He wrote about his encounter with Mickiewicz and about the impression he made on him, among other things, in his letters to his father. He contrasted two completely opposite opinions on the author of *The Crimean Sonnets*. After this face-to-face meeting with this great representative of the Polish Romanticism, Kraśiński's own opinion on him changed radically: „Oh! How falsely was he judged in Warsaw! He is a man of extensive learning; he speaks Polish, French, Italian, German, English, Latin and Greek. He is proficient in European politics, history, philosophy, mathematics, chemistry

and physics. No one in Poland has a better knowledge of literature than him. When you hear him talk, you might think he has read every single book in the world. His opinions are very serious and reasonable [12]”.

Despite such favourable opinion on Mickiewicz, the two poets never became friends. At that time, Krasiński corresponded with Reeve whom he regarded as his confidant, as he frequently mentioned in his letters. As Agnieszka Markuszewska has pointed out, “their correspondence is considered an important source of information about 19th century morality and customs, in particular the Romantic cult of friendship and love, cultural and historical community and Europe. Moreover, it testifies to the poet’s self-creation and spiritual path [13]”. Meanwhile, Maria Janion emphasises that “Despite his incredibly rich correspondence with various people who were very close to him, Krasiński probably never confided in anyone as much as in Reeve (...) [14]”.

One of the reasons for their friendship was Krasiński’s Anglomania which was all the rage at that time. He even stated that “If I weren’t a Pole, and prouder of this appellation than any other, I wish I’d been a born Englishman, not to be English, but to speak and write it [10]”. He was fascinated with English literature, especially Byron and Shakespeare. Krasiński read and discussed English poetry together with Reeve whom he considered highly intelligent and possessed of an outstanding literary talent. He often shared his moral dilemmas with him, including his regret that he was not able to fight in the November Uprising: “Only a miracle could change my circumstances and return me to the world [10]”. This contributed to his loneliness and alienation which he described in his letters in an exulted manner. However, the content of his correspondence gradually changed in favour of more profound matters, such as philosophy of history.

The poet’s views are reflected in all his works. Philosophy of history was the central theme, both of his literary works and letters. It is not without reason that Krasiński is regarded as a leading Romantic intellectual. Although he did not create his own philosophical system, he is counted among the most prominent thinkers of his time, along with August Cieszkowski, Bronisław Trentowski and Edward Jaroszyński.

Over the years, philosophy of history became the central theme of both his literary works and letters. His interest in the past was in line with the Romantic cult of tradition which – apart from mere memory of the past – was defined by the belief that national history had a decisive influence on every individual, regardless of personality. In the opinion of the Romantics, human existence only became meaningful through participation in a grand historical process. The constant struggle of the Polish nation for reclaiming its lost sovereignty inspired many thinkers who believed that its suffering was not pointless, but part of the divine plan of revelation of the Messiah who would bring the Kingdom of God to earth.

The first mentions of such broadly defined Messianism can be found in Gaszyński’s correspondence from the 1830s. In one of his letters, the poet tried to explain to his friend that the redemption of the world had to be preceded by suffering and that any great undertakings required time and sacrifice: “Don’t be overly hopeful and confident of success. Great designs are never accomplished within a short time. In order to save a nation, immeasurable suffering is necessary, in order to save the world, God Himself had to die. Nothing good or noble is possible in this world without long hardship [15]”.

Krasiński shared his reflections and emotions with a number of addressees, including Delfina Potocka, his second great love after Joanna Bobrowa. She was well versed in the social and political situation and the philosophical works of the first half of the 19th century. It was from Delfina's letters that he found out about Andrzej Towiański's lectures in Paris in 1840. This renewed the poet's interest in philosophy, which was reflected in his letters to Potocka from 1841 and 1842. Many of them resembled philosophical and didactic treatises. Krasiński frequently appeared in them as a mentor, e.g. he tried to explain Hegel's system to his lover: "Whatever mankind touches must unwittingly refer to its journey from God and its return to God. Mankind originated from God without any self-knowledge and is now progressing towards that self-knowledge. And when it returns to God, it will know both itself and God [...] Therefore, man opposes and negates God, but then he must negate himself and return to God. At that point, he will be both man and God, even though in the beginning, there was only God. Never take the word "negation" as hostile denial, but think about it this way: There is a chest of drawers, you open a drawer and it becomes a negation of the chest of drawers. And when you negate it again, that is when you close it, by this double negation you get the same chest of drawers as in the beginning. But now you know that the chest contains drawers and what is inside them, you know the whole truth about the chest of drawers [16]"!

After reading the above passage, one might doubt whether the poet managed to achieve his goal. Comparing Hegel's philosophy to a chest of drawers was probably not the best idea. His argument is rather chaotic and unclear and might have been counterproductive. However, one cannot doubt his good intentions and, above all, his wish to impress Potocka at any price.

His affair with Potocka embodied the Romantic vision of love in nearly every respect. It was a feeling that rejected all cultural norms and patterns, freed lovers from received conventions, giving them a sense of infinity and limitlessness, bringing them "into the higher realm reserved for rulers, saints, heroes and artists [17]". On the other hand, Romantic love was by definition marked with pain and suffering, and lovers were meant to struggle against adversity in order to experience any happiness at all. According to this Romantic vision of love, a happy end was out of the question, which also applied to Krasiński and Potocka.

The poet's correspondence with his beloved began in 1839, and they exchanged letters with each other regularly ever since. Only one seventh of the total number of approximately 5,000 letters they wrote have been preserved to this day. Their content varied but love remained their central theme. Each letter was meant as a homage and apotheosis of Delfina. Mateusz Dąbrowski has remarked that "Delfina was compared by the poet to an angel, a deity, a goddess, which echoes the Petrarchan tradition. Elements of angelology applied by Krasiński corresponded to the Romantic convention in which angelic figures were described as innocent and endowed with otherworldly beauty [18]". In his love letters, the poet often referred to his chosen one as an angel, e.g. "Golden Angel, bless those beautiful, sleeping rivers, infuse them with your wings' rays, transform them into silvery infinity, let your smile be reflected in those mists, encompassing the world like virgin veils! Go on, fly into the sky, my Angel [16]"!

Krasiński was trying to make a favorable impression on his chosen one. Along with his poems, he sent her various gifts – from romantic trinkets to very stylish and often expensive presents: "I have imagined a mystical bracelet for you with «Rome, Freiburg, Naples» (set in a triangle) and many more things. [...] I also ordered a few poems to be engraved on black marble for you. This marble



stone will rest on the bosom of your table. Sometimes, when crossing your room, you will turn it and read it. [...] On the other side of the gem for your bracelet, I will have the following words engraved: «You – Heaven – Me » (in the three corners of the triangle). A most mystical inscription. [...] The unity of love – the truth of two hearts and the truth of the entire world! Each living in the other one, and together forming a whole. Such whole is our God and our Spirit [16]". This present sent by Krasiński was meant to remind Potocka of her faithful and devoted lover. The inscription was very significant. It was a peculiar declaration of love testifying to the importance of words in Romantic rituals. Krasiński was known to observe the rituals of Romantic love that played a vital role in the customs of the 19th century.

Equally significant was the form of the letters itself. Many of them start and end with the poet's assurances of love, which form a compositional frame [19]. Sometimes, the reader might have the impression that the contents were overshadowed by the form. The meticulous attention to detail imparted new qualities to the letters. Frequent use of figures of speech, such as metaphors or similes, was supposed to embellish them and stir the addressee's imagination. The letters resemble pictures painted with words. "Krasiński called Delfina «Dialy» or «Didysza». He signed his name «Zyg.» or «Siżyś», as she called him in private. When writing about himself or repeating the words of third persons, he often used his surname «Krasiński». In his letters in French, he addressed her directly «Delphine» [20]".

Krasiński applied a wide range of techniques to appear as a typical Romantic lover, particularly in his letters. Owing to this correspondence, his love affair with Potocka is currently described as "the greatest novel of the Polish Romanticism [21]".

His letters portray all aspects of the Romantic period. Their content is extremely diverse, firstly, due to the author's numerous interests and eloquence and secondly, due to their limitless thematic range. This article is only an outline of the most prominent tendencies of that time, based on Krasiński's correspondence in its many facets. His letters represent a new development in Romantic epistolography, in terms of their function and literary qualities. Modern researchers have drawn attention to that their characteristic feature of intersectionality of different literary forms, including – apart from epistolography – prose, lyric verse, journalism and literary criticism, resulting in their complex, interwoven structure [22]. Krasiński's letters embody the concept of open work whose individual components, i.e. philosophical treatises or poems interact with each other [23], as pointed out by Bałajewski. Just as in his other writings, Krasiński's correspondence persistently broke all earlier conventions, norms and patterns, proving his literary mastery.

## **Literature:**

- [1] Z. Sudolski, *Polski list romantyczny*, Kraków: Wydawnictwo Literackie, 1997.
- [2] D. Grzesiak, *Struktura listu romantycznego*, w: *Sztuka pisania o liście polskim w wieku XIX*, J. Sztachelska, E. Dąbrowicz (red.), Białystok: Wydawnictwo Uniwersytetu w Białymstoku, 2000.
- [3] M. Danilewiczowa, *Zmienne koleje przyjaźni (Zygmunt Krasiński i Henry Reeve)*, w: *Krasiński żywy. Książka zbiorowa wydana staraniem Związku Pisarzy Polskich na Obczyźnie*, W. Gunther (red.), (red.), Londyn: Wydawnictwo B. Świdorski, 1959.



- [4] S. Skwarczyńska, Teoria listu, oprac. E. Feliksiak, M. Leś, Białystok: Wydawnictwo Uniwersytetu w Białymstoku, 2006.
- [5] Z. Sudolski, Wstęp do: Z. Krasiński, Listy. Wybór, Wrocław: Zakład Narodowy im. Ossolińskich, 1997.
- [6] Z. Sudolski, Krasiński. Opowieść biograficzna, Warszawa: Ludowa Spółdzielnia Wydawnicza, 1983.
- [7] D. Lalak, A. Ostaszewska, Źródła do badań biograficznych, Warszawa: Wydawnictwo Akademickie Żak, 2016.
- [8] S. Burkot, Polskie podróżopisarstwo romantyczne, Warszawa: Państwowe Wydawnictwo Naukowe, 1988.
- [9] J. Kamionka-Straszakowa, Zbłąkany wędrowiec. Z dziejów romantycznej topiki, Wrocław: Zakład Narodowy im. Ossolińskich, 1992.
- [10] Z. Krasiński, Listy do Henryka Reeve, oprac. i Wstęp P. Hertz, t. I, Warszawa: Państwowy Instytut Wydawniczy, 1980.
- [11] J. Lyszczyna, Zygmunt Krasińskiego gorączka podróży, w: „Gdzie piękność, gdzie poezja...?” Zygmuntowi Krasińskiemu w 200. rocznicę urodzin (1812-2012), A. Czajkowska, E. Mika (red.), Częstochowa: Wydawnictwo im. Stanisława Podobińskiego Akademii im. Jana Długosza w Częstochowie, 2012.
- [12] Z. Krasiński, Listy do ojca, oprac. i Wstęp S. Pigoń, Warszawa: Państwowy Instytut Wydawniczy, 1963.
- [13] A. Markuszewska, Poetyckie światy romantyków. O młodzieńczej korespondencji Zygmunta Krasińskiego i Henryka Reeve’a Toruń: Wydawnictwo Naukowe Uniwersytetu Mikołaja Kopernika, 2017.
- [14] M. Janion, Zygmunt Krasiński – debiut i dojrzałość, Warszawa: Wiedza Powszechna, 1962.
- [15] Z. Krasiński, Listy do Konstantego Gaszyńskiego, oprac. i Wstęp Z. Sudolski, Warszawa: Państwowy Instytut Wydawniczy, 1971.
- [16] Z. Krasiński, Listy do Delfiny Potockiej, oprac. i Wstęp Z. Sudolski, t. I, Warszawa: Państwowy Instytut Wydawniczy, 1975.
- [17] M. Piwińska, Miłość romantyczna, Kraków: Wydawnictwo Literackie, 1984
- [18] M. Dąbrowski (2016). Zygmunt i Delfina. Miesięcznik Literacki Akant 2016  
<http://akant.org/archiwum/165-archiwum-miesiecznik-literacki-akant-2016/akant-2016-nr-11/5489-mateusz-dabrowski-zygmunt-i-delfina>, 17.07.2021.
- [19] J. Kulwicka-Kamińska, *Korespondencja Zygmunta Krasińskiego z Delfiną Potocką. Analiza językowo – stylistyczna na tle tendencji artystycznych epoki romantycznej. In Acta Universitatis Nicolai Copernici. Nauki Humanistyczno-Społeczne. Filologia Polska, 1997, vol. 48.*
- [20] W. Hoesick, Miłość w życiu Zygmunta Krasińskiego, przed. P. Chmielowski, Warszawa: Biblioteka Dział Wyborowych, 1985.
- [21] J. Kott, Największa powieść polskiego romantyzmu, w: Z. Krasiński, Sto listów do Delfiny, oprac. J. Kott, Warszawa: Czytelnik, 1966.
- [22] zob. A. Waśko, Zygmunt Krasiński. Oblicza poety. Kraków: Wydawnictwo ARCANA, 2001.
- [23] Bałajewski, Poezja „trzeciej epoki”. O twórczości Zygmunta Krasińskiego w latach 1836-1843, Lublin: UMCS-Uniwersytet Marii Curie-Skłodowskiej, 2009.

## THE PEOPLE OF THE DUTCH EAST INDIA COMPANY IN THE BOTANICAL NAMES. A POLYCONFRONTATIVE APPROACH

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### **Abstract:**

In the article the author concentrates on the problem of a selected group of eponyms in botanical names, namely those connected to the people of Dutch East India Company. Those included travellers, governors, physicians and botanists. The polyconfrontative analysis of this group of plant names includes botanical names in Polish, Czech, English and Dutch and the degree of their equivalency with the Latin names. Both genus name and the specific epithet in the binomial names have been analysed.

### **Keywords:**

*binomial nomenclature, polyconfrontative studies, Dutch East India Company, plant names, genus name, specific epithet*

### **Introduction**

From the earliest days humans moved from place to place. The reasons of minor and major migrations have been omnifarious: from basic vital needs like search for food and hunting, religious pilgrimages, through wars and territory defence, to exploration and search of knowledge. Also the means of transportation have varied through centuries: from feet and horses (and animals in general), through carriages (for road journeys) and ships (for maritime travels e.g. in the Golden Age), to cars and planes nowadays. One of the phenomena that combined most of all those needs was the VOC.

### **The VOC**

Established in 1602 the *Vereenighde Oostindische Companie* (VOC; *The Dutch East India Company*) was one of the phenomena that influenced the way of travelling in 17<sup>th</sup> and 18<sup>th</sup> centuries. The VOC was the first trading company to issue stock and bonds to the general public. It consisted of six so called *Kamers* (*Chambers*) that were located in the main Dutch port cities, i.e. Amsterdam, Delft, Rotterdam, Enkhuizen, Middleburg and Horn. The Chambers had their representatives who constituted the ruling/managing board i.e. the *Heeren XVII* (*the Lords Seventeen*). They defined the general policy of the VOC and were responsible for building their own ships and warehouses and

trading the merchandise. It was considered in the period of its functioning one of the largest private employers of those times. During the Golden Age numerous people of different professions and different nationalities worked for the VOC [1]. Among them one can find also Carl Linnaeus – the famous botanist from Sweden.

### **Carl Linnaeus and the botanical binomial nomenclature.**

Carl Linnaeus (1707-1778) a botanist that was born in Sweden but spent some of his life in the Netherlands. His biggest achievement was ordering the vastness of botanical literature, systems of classification and new plants. Linnaeus wrote numerous works in the field of botany, the most important of which must be considered *Genera Plantarum* (1737) and *Species Plantarum* (1753). The works introduced the so-called 'Gender System' of plant classification, which in spite of its simplicity did not take into consideration the kinship of particular species [2]. Linnaeus presented his system of classification in 1735 in *Systema Naturae*, however it contained the classification of all known living species (not plants exclusively). His later work *Genera Plantarum* contained a register and short descriptions of plant genera which had been distinguished by Linnaeus and those that had been included among others in the work of Bauhin – the *Pinax Theatri Botanici*, who in turn created a register of all plants known in their times.

In his works Linnaeus described numerous plants not solely using the names from earlier botanists' works, but he also introduced many names inspired by classical literature or created in honour of famous botanists (e.g. *Fuchsia*, *Bauhinia* etc.). On the other hand, in the *Species Plantarum* different species with their names and short descriptions were barely enumerated, in relation to previous publications containing information about a specific species together with its synonyms, habitat and provenance. The importance of this work lied in the Linnaeus' comments added (beside the descriptive phrase of each species) a one-word common name on the margins, that is the specific epithet.

As assumed they were initially used to index the species, but quickly they proved themselves to be a very big convenience and rapidly became standard names for plant species. As a rule the specific epithet was a repetition of a keyword from the descriptive phrase, in some cases, however, it could be created separately [2]. The publication year (1753) of the first edition of *Species Plantarum* was declared a turning point in taxonomy, namely in the use of binomial nomenclature.

Nowadays the rules for plant naming are gathered in the so-called *Shenzhen Code 2018* (*International Code of Nomenclature for algae, fungi and plants*) [3]. However, some of them refer to the year of publication of *Species Plantarum* as the reference year for e.g. the priority rule [2].

### **People connected to VOC in botanical names**

The VOC functioned in different areas and its scale of activity covered almost all contemporary widely comprehended businesses. The people of those times were connected to the VOC directly or indirectly. Those were mainly merchants, travellers, governors but also doctors and botanists [4]. Some of them were commemorated in the botanical names. In fact, eponyms are quite common way of creating plant names in the eighteenth century.

The eponyms can be found both in the genus name and the specific epithet, however, the first names created according to the Linnaeus' binomial nomenclature referred to the people of VOC mainly in genus names.

One of the genus names commemorating a famous person is *Altingia* [5, 6]. The genus comprises different tree species with natural habitats in East Asia and Malaysia. The plants own their name to Willem Arnold Alting (1724-1800), who was a merchant and later the Governor-General of the VOC in Batavia (nowadays Indonesia). The eponym is preserved in all the analysed languages to a different degree. English and Dutch use the unchanged Latin name, whereas the Slavonic languages make use of a name (borrowing) after phonological and spelling assimilation (PL: *altyngia*, CS: *altingie*).

Johann Bartsch (1709-1738) was a physician who graduated from the Leiden University in 1737 and helped Linnaeus in publication of his first work *Flora Lapponica*. He was interested in botany and therefore used the opportunity to travel to Suriname and describe its flora. The name of a flowering plant genus *Bartsia* was given by his friend Linnaeus and published in *Species Plantarum*. The genus comprises several species, only one with natural habitat in Europe – *Bartsia alpina*. The species has its Dutch name (*alpenhelm*) that does not refer to the botanist but describes the shape in genus name (*helm*) and habitat in the specific epithet (*alpen*). The English name (*velvet bells*) does not contain an eponym either. In its name it refers to the shape (*bells*) and structure of the flower (*velvet*). On the other hand, both the languages while referring to the genus in general use the Latin name *Bartsia*. In Polish the genus name in the species name (*bartsja alpejska*) contains the eponym that underwent phonological (spelling) assimilation. The Czech name has a few synonyms, one of them does not commemorate J. Bartsch but refers to the plant morphology (*lepnice alpská*). On the other hand, the other synonymic name (*bartsia alpinská*) is a direct borrowing from Latin (in the genus name). What seems interesting the name that was used previously was an assimilated borrowing (*bartska horní*).

Another physician and botanist whose name was the basis for creating a botanical name is Jacob de Bondt (Jacobus Bontius, 1592-1631), who since 1627 worked for the V.O.C. in Batavia. The species named after him (*Bontia daphnoides*) is a bush or small tree with its natural habitat on Caribbean Islands. The plant is usually referred to in all the described languages under the Latin species name. While in English there exist common names (*wild olive*, *white alling*) that refers to the plant morphology not to the name of above mentioned scientist and traveller.

The genus name *Breynia* is the eponym created to honour the Dutch merchant and botanist Jakob Breynia (1637-1697) who lived in Gdańsk but went for some research travels with VOC (especially in the field of botany). His works were also inspiration for some works of Linnaeus. The Latin genus name *Breynia* is preserved in all the discussed languages, while in Czech it is also assimilated in spelling. It is worth mentioning that one of the species – *Breynia oblongifolia*, that is native to South East Asia is often referred to as 'coffee bush'.

George Clifford III (1685-1760) was a Dutch banker and one of the directors of the VOC, whose passion for botany led indirectly to changes in the botanical taxonomy. He hired Linnaeus to catalogue all his collection of exotic plants which enabled him to write the *Hortus Cliffortianus* and consequently *Genera Plantarum* and *Species Plantarum*. The plant genus *Cliffortia* was created by Linnaeus who described it in his *Species Plantarum*. The species belonging to this genus are native

to the South Africa, therefore they do not use other names in the analysed languages, but English. The name *Caperose* refers to the standard habitat of the species.

Another doctor and botanist that was indirectly connected to VOC by the end of his life was Charles de l'Écluse (Carolus Clusius, 1526-1609) who among others introduced the methods of tulip horticulture and thus laid foundations to the future of the Dutch tulip bulbs industry. His name was commemorated by Carl Linnaeus in the name of the *Clusia* genus. In this case English and Czech use the Latin name only. The Polish name is a spelling assimilation of the Latin name, however, the language has created its own name (*okretnica*) which is not an eponym, but reference to the plant morphology. In case of Dutch, apart from the Latin name the genus is often referred to as *varkensboom* (literally 'swine's tree').

The Dutch governor Dirk de Haas (?-1702) who travelled for VOC to India as a simple sailor and after some time became the Governor of Ambon (in years 1687-1691), was the inspiration for the genus name *Dehaasia*. The eponymic character of the botanical name is preserved in all the analysed languages as they do not have common names and make use of the Latin genus name.

Peter Hotton (Petrus Houltuyn, 1648-1709) was a Dutch botanist and professor at Leiden University who was indirectly connected to the VOC as a supervisor of the university botanic garden, responsible for exchanging seeds and plans. His name was used to name a small plant genus *Hottonia*. The genus comprises only two species *Hottonia palustris* and *Hottonia inflata*. The first of them was described by Linnaeus in *Species Plantarum*. This species is referred to as *waterviolier* in Dutch, whereas in general the Latin name is used as the genus name. In English apart from the Latin genus name a name that refers to the both species, namely *featherfoil*, is used. It seems worth mentioning that the Slavonic languages use their own names referring to the morphology of the plant (PL: *okretnica*, CS: *žebrotka*), but not to the famous botanist.

Carl Linnaeus (1707-1778) who was also called the 'father of taxonomy' [1] was honoured with the plant name as well. The genus *Linnaea* comprises only one species *Linnaea borealis*. The plant was Linnaeus' favourite and it was described by him in *Species plantarum*, where he added the specific epithet *borealis*. This plant has its equivalents in all the described languages but not all of them contain the eponym. In English apart from the officially used Latin name, a common name *twinflower*, which refers to the species morphology, can be used. The Czech botanical name refers to the vegetation period only (*zimožel severní*). On the other hand, Polish has two synonymic names, one being an eponym (*linnaea północna*) and the other one that refers to the vegetation type (*zimoziół północny*). The Dutch equivalent contains the full Linnaeus name instead of the Latin genus name (*Linnaeusklokje*).

Matthaeus Lobelius (Mathieu de l'Obel, 1538-1616) was a Flemish physician, royal botanist who tried to create a system of plant classification. The genus named after him is *Lobelia* that comprises numerous species. In this case, both English and Dutch genus names use the Latin botanical name. In Czech the name is an assimilated borrowing in the diminutive form (*lobelka*). On the other hand, Polish has two synonymic genus names, one that is directly borrowed from Latin (with minor spelling assimilation) and the other one that refers to the interesting plant morphology (*stroiczka*).

Pieter Gerardus van Overstraten (1755-1801) – the last Governor-General of the VOC on Java, was honoured by the genus name *Overstratia*, which was later changed to *Sauraiia*. Therefore, the genus functions only in the Latin name in the analysed languages.



The genus *Rafflesia* is an exotic genus, that was named after the British clerk in the Dutch East V.O.C. colonies and also a botanist Thomas Stamford Bingley Raffles (171-1826). The Latin genus name is used in English and Dutch and as assimilated borrowing in Czech (*raflézie*). In Polish the genus is known as *bukietnica* which refers to the giant flowers of the plants.

The genus *Schoutenia* is another genus name that is used in the Latin form in all the described languages. It is an eponym based on the name of a Dutch sailor Wilem Cornelis (Corneliszoon) Schouten (ca. 1580-1625) who in 1615 as a captain of *Eendracht* travelled in search of new route to India.

*Tasmannia* is a genus name of an evergreen bush native to Australia and New Guinea that was named after Abel Janszoon Tasman (1603-1659). This Dutch merchant and sailor commissioned for the V.O.C. as a cartographer mapped *Terra Australis*. The Latin genus name is used as a botanical name in all the taken into consideration languages. However, the plant is commonly referred to as *pepperbrush* in English.

Carl Peter Thunberg (1743-1828) was a Swedish physician and botanist who served for V.O.C. as the ship's surgeon. During his travels he reached Kaaps, Java, Deshima and described exotic plants in his *Flora Japonica*. It seems worth mentioning that he is one of the few people who were honoured by a few plant names both in the genus name and the specific epithet. The Latin genus name *Thunbergia* is used as a botanical name in Dutch and English, while in Polish it is an assimilated borrowing with minor changes in spelling (*tunbergia*). The Czech name, however, is created independently and does not contain an eponym (*šmatatka*, *smatavka*). Thunberg was also commemorated in the specific epithet of the following plant species: *Nyphnoides thunbergiana*, *Pinus thunbergii*, *Crassula thunbergiana*, *Gardenia thunbergia* and *Berberis thunbergii*. The last species is quite commonly cultivated in gardens. The eponym in the specific epithet is preserved in the Polish (*berberys Thunberga*), Czech (*dříšťál Thunbergův*) and one of the English names (*Thunberg's barberry*). The other English (*Japanese barberry*) and the Dutch (*Japanse berberis*) specific epithets refer to the origin of the species. The last English specific epithet (*red barberry*) depicts the plant morphology, namely the colour of the leaves.

The genus *Tulbaghia* is an eponym that honours Ryk Tulbagh (1699-1771) who was a merchant and the governor of the Cape Colony. He was corresponding with Linnaeus and discussing different exotic plant species. The Latin genus name is used in Dutch and English, while Czech (*tulbagie*) and Polish (*tulbagia*) use the assimilated borrowings (with minor spelling changes). It seems interesting that both English (*wild garlic*, *society garlic*) and Dutch (*wildeknoffel*, *wilde knoflook*, *Kaapse knoflok*, *moeraslook*) created common names that refer to other features of the plant, i.e. habitat, origin etc.

Christopher Carl Friedrich von Wurmb (Fredrick Baron van Wormbe, 17742-1781) was a German-Dutch merchant, a clerk in the colonies that as a botanist described among others different palm species. His name was the basis for creating the genus name *Wurmbea*, that is used in all the analysed languages as botanical genus names.



## Conclusions

As seen in the presented material, the eponyms were quite productive way of naming plants in the eighteenth century. The people that were mainly commemorated with the plant names were widely comprehended travellers: first of all the botanists and merchants, less frequently physicians and governors. It seems significant that most of the names appear in the genus name, only a few of them were found in the specific epithet. It might be justified by the fact that the binominal nomenclature was not widely used in those times yet. As far as the degree of equivalence is concerned, it may be stated that the Latin botanical genus names are quite often used in other analysed languages as borrowings with only minor spelling and phonological adjustments. Only a few names have acquired local (or common names) in other languages (mainly in Polish and Czech). It might be due to the fact that the names that were named after people of the VOC were given to the plants that are native to exotic countries and have not become widely cultivated in Europe.

## Literature

- [1] The information on history and people working for V.O.C. have been retrieved from: [www.vocsite.nl/geschiedenis/personalia/](http://www.vocsite.nl/geschiedenis/personalia/); <https://voc-kenniscentrum.nl>, 05.06.2021.
- [2] C.A. Stace, *Taksonomia roślin i biosystematyka*, Warszawa: PWN, 1993.
- [3] *The Shenzhen Code 2018*, <http://ibot.sav.sk/icbn/main.htm>, 05.06.2021
- [4] The names are given in the alphabetical order.
- [5] The characteristics of plant species have been retrieved from the online database of Royal Botanic Gardens in Kew – *Plants of the World Online*, Royal Botanic Gardens, Kew, retrieved from <http://www.plantsoftheworldonline.org> on 05.06.2021
- [6] All the species names have been taken from the works of the following authors: Anioł-Kwiatkowska [7], Backer [8], Heukels [9], Kleijn [10], Meijden [11], Quattrocchi [12] and the website botany.cz [13].
- [7] J. Anioł-Kwiatkowska, *Wielojęzyczny słownik florystyczny*, Wrocław: Wydawnictwo Uniwersytetu Wrocławskiego, 2003.
- [8] A. Backer, *Verklarend woordenboek van wetenschappelijke plantennamen: de namen van de in Nederland en Nederlands-Indië in het wild groeiende en in tuinen en parken gekweekte varens en hogere planten*. LJ Veen, 2000.
- [9] H. Heukels, *Woordenboek der Nederlandsche volksnamen van planten*. Nederlandsche Natuurhistorische Vereeniging, 1907.
- [10] H. Kleijn, *Planten en hun naam: Een botanisch lexicon voor de Lage Landen*, Amsterdam, 1970.
- [11] R. van der Meijden, *Heukels' Flora van Nederland*, Nijmegen: Noordhoff Uitgevers B.V., 2005.
- [12] U. Quattrocchi, *CRC world dictionary of plant names: common names, scientific names, eponyms, synonyms, and etymology*. Routledge, 2017.
- [13] [botany.cz](http://botany.cz),  
<https://botany.cz/cs/rubrika/herbar/>, 05.06.2021



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