FORENSIC IDENTIFICATION BASED ON BIOLOGICAL TESTING IN CROSS-BORDER CRIMINAL PROCEEDINGS:
LEGAL, METHODOLOGICAL AND PRAXEOLOGICAL ASPECTS

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INTRODUCTION

This book presents the results of scientific inquiries conducted in the Interreg 110 project entitled *The Correlation of Identification and Combating Cross-Border Terrorism-Related and Criminal Links in the Field of Genetic and Information Technology Testing*. The research team consists of dozen of scholars and practitioners, and their efforts are included into six sections of this monograph. Considerations are devoted to issues of the financial aspects of European projects, characteristics of Polish and German legal systems, evidentiary proceedings, and the cross-border collaboration in the frame of the European Investigative Order. Special attention has been paid to means of evidence in the form of expert witness opinions, especially in genetic (DNA) analysis. A crucial part of this book is dedicated to forensic identification and the significance of biological methods in forensic sciences from the point of view of effective cross border prosecution. Due to achieving a complex study, remarks have been given on the tasting procedures for forensic court laboratories.

Not only the issues analysed in the book but also the applied methodology are compound. The descriptive-analytical methods combined with empirical and statistical have been used. The descriptive-analytical aspects depend on the areas of application. On the one hand, the theoretical and comparative descriptions created the fundament for legal inquiries. On the other analytical method was strictly linked with the empirical, even experimental research of forensic sciences.

ABOUT THE PROJECT: COMBATING TERRORISM-RELATED CROSS-BORDER CRIME – FORENSIC LABORATORIES' JOINT EFFORTS

TOMASZ TRAWIŃSKI, MAREK JASZTAL, EWA MAŚLANA, TOMASZ IMIELA*

Forensic DNA analyses are used successfully to identify individuals in case of criminal offences, as well as during the identification of human corpses and remains. The development of the testing technology, and methods of interpreting test results and statistical analysis, provides that a genetic testing expert's opinion is scientific evidence of a significantly limited level of subjectivity. The sensitivity of test methods enables DNA profiling even from a small number of cells that have been brought onto the surface of evidence as a result of a person's contact with the object. What is more, statistical analysis methods enable calculations based on which it will possible to identify individuals even when incomplete arrangements of DNA polymorphic traits have been obtained.

The abovementioned features of genetic testing, that is their scientific character, sensitivity, and analysis of results based on an objective mathematical foundation, predispose these to be made use of during the process of demonstrating evidence for the perpetration of a terrorism-related crime, as well as enable reliable identification of the victims of a terrorist attack. As existing in Europe, the former threats have resulted in a necessity to take adequate preventive measures. These are based on developing a uniform procedure for forensic identification of the perpetrator of a crime and implementing into practice the existing procedures of identifying victims of an act of terror, as performed.

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Due to the geographical location of Szczecin (in the vicinity of the state boundary), terrorism-related crimes will most likely be of a cross-border character. This has been confirmed by practice so far: the terrorist attack in Berlin on 19 December 2016. Both German and Polish police units took part in the process of identifying the victims. Following the conclusion of the procedural acts, an audit was conducted within the international proceedings which aimed to define the reasons for the problems which affected the method of testing and exchange of results between the Polish and German sides. The assessment was concluded with pertinent recommendations, concerning, in particular, a necessity to:

a) define differences between the German and Polish legal systems; these differences pertain, among others, to various aspects of evidence;
b) bcarry out a unification process concerning testing methods, as applied;
c) cperform a statistical analysis of the specified methods;
d) and to develop an algorithm for joint proceedings.

For these reasons, a cross-border laboratory "consortium" was established within the project, consisting of equal partners with precisely defined tasks to be performed.

The international research team was composed of public prosecutors and police officers from Poland and Germany, Polish and German legal experts in the field of genetic testing, support personnel from police forensic laboratories in Poland and Germany, as well as researchers from the Department of Forensic Genetics of the Pomeranian Medical University. Also, lawyers engaged in scientific analysis of law and criminal procedure participated in the creation of the laboratory team, those were associated with the Faculty of Law and Administration of the University of Szczecin and the Faculty of Law and Administration of Adam Mickiewicz University in Poznań. They analyzed the partner states' legal systems. On the other hand, experts of the Faculty of Natural Sciences of the University of Szczecin developed and implemented into forensic practice a methodology for the identification of types of biological substances based on genetic marker analysis.

As a result of the interdisciplinary team's activity, tasks were defined for respective entities (partners) and the scope of their activity was diversified. The hardware platform was unified and mutually compatible software was installed. In addition, a secure, IT communication channel was launched between the partners' laboratories which enabled the transmission of genetic and IT test results in the form of files. Project undertakings, as executed, allowed to unify testing methods and the way to perform statistical analysis and the inference model. The actions taken within the project offer a truly real possibility to reduce the time needed to perform forensic examinations concluded with an expert's opinion that would meet the requirements for being included in the body of evidence, as valid both in proceedings pursued in Poland and ones taking place within the Federal Republic of Germany.

The undertakings, as executed within the project, led to the establishment of a uniform management algorithm comprising not only elements of genetic testing, but also juridical issues related to the complex aspect of their international legal procedural validity. Moreover, methods were elaborated for the transfer to the partners of sensitive data (e.g. DNA profiles) between forensic laboratories of the engaged partners.

The main focus of the project was put on an exchange of experience. Ten events were organized: three conferences, five seminars, workshops on genetic testing, and a practical exercise – a simulation of a terrorist attack (let us add: with a high level of realism).

The entities involved in the execution of the project included, as follows:

a) the Provincial Police Headquarters in Szczecin – the project leader;
b) the Mecklenburg-Western Pomerania State Criminal Police Office – a budget partner, invited to participate in the project;
c) the Pomeranian Medical University in Szczecin (the Department of Forensic Genetics) – a budget partner, invited to participate in the project;
d) the University of Szczecin (the Faculty of Law and Administration, the Faculty of Natural Sciences) – a partner, invited to participate in the project.

The entities cooperating in the execution of the project, on the other hand, were the following:

a) the Regional Crisis Management Centre in Szczecin;
b) the Provincial Headquarters of the State Fire Service in Szczecin;
c) the Regional Emergency Rescue Service Station in Szczecin.

FINANCIAL ASPECTS OF EUROPEAN PROJECTS

EUROPEAN PROJECTS AS A TOOL TO SUPPORT POLICE ACTIVITIES – A SUPERVISORY APPROACH

MAREK JASZTAL*

Introduction

Safety is the lack of threat, the certainty, and stability of functioning of both individual citizens and organized societies, in all areas of their activity. The performance of the statutory tasks of the Police focuses on ensuring public security. The police comply with the above thesis in the execution of their tasks resulting from Article 1 of the Act of 6 April 1990 on the Police,[1] as well as the implementing acts of delegated legislation to have been promulgated thereunder, both generally applicable and internal ones. Ensuring public security should be understood as an aggregate of actions implemented by the state and citizens that make one be able to feel safe. Security needs concern peace, freedom from fear, and dependence. They encourage action and ensure integrity. They manifest themselves when the existing habits prove of little use. Basic needs, pertaining to physiology and security, when not satisfied, prevail over all other ones, push these into the background and determine the behaviour of a human being.

The execution of tasks of the Police related to the provision of public services – as regards ensuring public safety and order – requires that funding be secured for the operation of Police units. The basic source for securing financial means as required to provide for the operation of the Police is the state budget being at the disposal of the Minister of the Interior and Administration.

The need to introduce modern techniques for the execution of the tasks of the Police, improve the conditions of the duty and citizens' service, as well as pursuit of a systematic increase of the level of knowledge, qualifications and experience of Police

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1 The Act of 6 April 1990 on the Police (Journal of Laws of 2011 No 287, Item 1687, as amended).

officers and employees, necessitates seeking additional funds to support the available national means.
The most important potential source of obtaining funds to support the process of developing the function of the Police with respect to knowledge, innovation and know-how is at present, and will continue to be for the decade to come, European funds.
Applying for, obtaining and using European funds requires that supervisory mechanisms be designed, implemented and monitored, as serving to provide for the legality, efficiency and purposefulness of actions, both at the stage of their acquisition, use and settlement of the funds, including the provision of the durability of projects.

The role and tasks of the Police

The Police fulfil an unquestionably important function in the life of every citizen. Without providing for an adequate level of security, social and economic life would be significantly impeded.[2] The role of the Police in modern society is inestimable. The lasting source and essence of the social demand for police services, as well as the influence of social expectations on the way in which tasks assigned to the Police are executed, requires the aspiration that the powers of the Police be executed in a legal, effective and efficient manner. The performance of the Police functions regards the necessity to implement actions of both supportive and repressive character. It is a difficult and complex task to define the proportion between applying repression and playing the role of a guardian.
In order to keep themselves safe, every citizen is obligated to waive a part of their freedoms and liberties. The Police is one of the dispositional groups whose emergence was forced by the civilizational development. Ever since the human being started to lead a sedentary lifestyle, in larger and larger population centres, his/her personal abilities to ensure security for himself/herself, his/her family and belongings began to be insufficient. This resulted, among others, from gradual retirement from the necessity to play the role of a warrior by every man. Focusing on the pursuit of one's trade and the increasing tendency to social division of labour, societies requested the need for being ensured security from outside, it is from outside one's home, one's family. In response to this demand were, to some extent, the armed forces of the first rulers of emerging states. Those forces, on the one hand, defended the citizens against external threats, on the other, however, they were a tool to impose the ruler's will. Simultaneously, more and more of such forces were in demand in expanding

2 M. Wierzbicki, "Miejsce Policji w życiu społecznym", *O Bezpieczeństwie i Obronności. De Securitate et Defensione* 2017, No 1(3), p. 145.

states, taking the shape, in time, of the modern dispositional groups, including the Police as well.[3]

The Police is the largest state service performing tasks on a permanent basis throughout the country. The execution of the tasks resulting from the Police Act of 6 April 1990 concerns ensuring internal security in the territory of the Republic of Poland. As a uniformed and armed formation, the Police are to serve society. They have been called into being for the purpose of protecting people's security, but also ensuring public safety and order. The powers of the Police are executed via the apparatus of 103 thousand of Police officers and 25 thousand Police employees.

The Police are a uniformed and armed formation serving the society and intended for the protection of people's security as well as maintenance of public safety and order. The tasks of the Police have been defined in the provisions of the Police Act. The detailed scope of the tasks of the Police has been presented in the below table (1).

Table 1. Tasks of the Police

Legal basis	Tasks of the Police
The basic tasks of the Police resulting from the provisions of the Police Act of 6 April 1990	protection of people's lives and health as well as property against unlawful attempts to infringe these interests
	protection of public safety and order, including ensuring peace in public places and means of public transport, in traffic on roads and waters intended for general use
	initiation and organization of activities aiming at prevention of crimes and minor offences as well as criminogenic phenomena and cooperation in this respect with state and local authorities and social organizations; carrying out counterterrorist operations within the meaning of the Act of 10 June 2017 on anti-terrorist operations
	detection of crimes and minor offences as well as prosecution of the perpetrators of the same; protection of buildings comprising the seats of members of the Council of Ministers, to the exclusion of structures serving the Minister of National Defence and the Minister of Justice, as specified by the minister competent for internal affairs
	supervision of specialized armed security formations within a scope as defined in separate regulations
	control of compliance with enforcement and administrative regulations related to public activity or in force in public places
	cooperation with other states' police forces and their international organizations, as well as the bodies and institutions of the European Union based on international covenants and agreements and separate regulations
	processing of criminal information, including personal data
	keeping data sets containing information collected by authorized bodies on persons' fingerprints, unidentified fingerprints from crime scenes and results of deoxyribonucleic acid (DNA) analyses
	execution of tasks resulting from the law of the European Union as well as international covenants and agreements according to the principles and scope as specified therein
	performance of activities executed on the basis of the Act of 9 March 2017 on the monitoring system for the carriage of goods by road and rail.

Source: own elaboration based on the Police Act of 6 April 1990.

3 S. Jarmoszko, "Perspektywy grup dyspozycyjnych w społeczeństwie nasilającego się ryzyka", in: *Teraźniejszość i przyszłość grup dyspozycyjnych*, J. Maciejewski, I. Wolska-Zagota (eds.), Wrocław 2013, pp. 28-29.

The tasks of the Police, as defined in detail, are executed by Police officers and employees on duty in the Police organizational units. Every person employed by a Police unit is assigned to a substantially separated police service, responsible for the execution of a specific scope of tasks. According to the provisions of the Act of 6 April 1990 on the Police, The Police consists of the following branches of service:

- preventive,
- criminal,
- investigative,
- counterterrorist,
- internal affairs,
- supporting Police operations in organizational, logistic and technical respects.

The detailed tasks of the police services have been specified in the next table (2).

Table 2. Tasks of the services in the Police

Branch of service	Tasks
Preventive service	The service executes patrol and intervention tasks in respect of undertaking activities aiming at the protection of people's lives and health as well as property against unlawful attempts to infringe these interests.
Criminal service	Executes operational and investigative activities pertaining to combating criminal and drug-related offences targeted at supporting the detective process.
Investigative service	The service has been called into being for the purpose of combating organized crime of a cross-border, criminal, drug and economic character, as well as related to terrorist acts.
Counterterrorist service	Is responsible for carrying out counter terrorism operations and supporting Police organizational units' activities under a specific threat or requiring the use of specialized resources as well as a specialist operational tactic.
Internal affairs service	The internal affairs service performs tasks throughout the country concerning detection, prevention and combating crimes committed by Police officers and employees, as well as crimes against business trading committed to the detriment of the Police, and also detection and prosecution of the perpetrators of such crimes.
Service supporting Police operations in organizational, logistic and technical respects	The tasks of the service pertaining to the continuous provision of technical and organizational conditions as necessary for the performance of the Police's tasks. These comprise also all activities targeted at the flow of external information and provision that funding be secured for the operation of the Police.

Source: own elaboration based on the Police Act of 6 April 1990.

The goals, functions and tasks of the Police, as specified in the provisions of the Police Act, as well as in other legislative acts defining assigned tasks performed by the separated police services, are executed within the organizational structures of Police units.

The Police ensure protection of the most valuable interests and values for the human being and society. Society establishes a list of prohibited acts and creates a hierarchy of protected values.[4] This execution is based, on the one hand, on the compliance with the applicable law by citizens, and on the other: on the enforcement of the law by bodies and institutions as appointed for this purpose.[5] The observance of adopted norms and rules is a domain of the Police.

The performance of the goals and tasks of the formation, as specified in the provisions of the basic law, the competence law and the internal regulations binding the Police, is exposed to significant risks that should be identified and analyzed. Systematic actions should be implemented to mitigate risk materialization.

The largest scope of tasks of the Police is assigned to the Police's field units, among which the biggest organizations are the Provincial Police Headquarters. The Provincial Police Headquarters are budgetary units. It is a public finance sector organizational unit, without legal personality, which covers its expenditures directly from the budget and discharges collected revenues, respectively, into the account of state budget revenues or into the account of the local government unit. A budgetary unit operates under a statute defining, in particular, its name, seat and objects, whereas the basis of its economy is provided by the revenue and expenditure plan.[6] The Provincial Police Headquarters have operated since 1990. Their present form and tasks, in particular as resulting from the Act on public *finance*, have been obtained since 2003. The Provincial Police Headquarters were established on the basis of a decision of the Minister of Internal Affairs.

European funds in the Police funding system

The performance of the statutory tasks of the Police requires that necessary funding be secured. The budget of the Police must provide for the possibility of financing, in a given budget year, of the tasks resulting from Art. 1 of the Police Act, as well as the implementing acts of delegated legislation to have been promulgated thereunder, both generally applicable and internal ones.

Taking account of the above division of tasks and services, the planning of the financial resources of the Police must be based on the following:

- definition of the optimum size and structure of employment,
- provision of funds for the execution of the training policy,
- determination of needs as regards tangible costs,

4 K. Wijak, "Człowiek w prawie karnym", in*: Człowiek w społeczeństwie i prawie*, M. Czarkowska, J. Kutta (eds.), Bydgoszcz 2013, pp. 95-97.

5 S. Pilipiec, P. Szreniawski, *Socjologia administracji*, Lublin 2008, p. 75.

6 As provided in the Act of 27 August 2009 on public finance (Journal of Laws No 157, Item 1240).

– specification of required repair and modernization works within Police facilities,
– establishment of the level of funds for investment purchases.

Since the moment Poland joined the European Union, an essential financial instrument supporting the police with respect to the execution of the investment and training policies have been European funds. European funds available for the Police units of the West Pomeranian garrison have amounted to several million Polish zlotys a year and constituted around 10 percent of the budget dedicated to investment and training activity. European Union funds are accumulated by the Member States and transferred into the EU budget. By law, these funds comprise the European Union's own resources.[7] The purpose of European funds' allocation is the implementation of the policies: the cohesion policy, the agricultural policy and the broadly understood economic policy, that is ones whose proper execution is intended to help increase the competitiveness of the European Union and have a positive impact on the development of, among others, agriculture, infrastructure, education, the security system. The budget also offers financing of the administrative expenses of supporting the European Union institutions, as well as humanitarian and developmental aid for countries from outside the European Union.

One of many potential beneficiaries of the European funds available within national budgets are the Police, being an eligible entity to apply for co-financing of both indicative and competitive projects.

The Provincial Police Headquarters in Szczecin uses the European co-financing in a number of areas. Cross-sectional tasks executed by the Provincial Police Headquarters in Szczecin and financed with European funds are reflected in the below table (3).

Table 3. Projects implemented at the Provincial Police Headquarters in Szczecin

No	Programme	Project value	Project scope
1.	Operational Programme Fisheries and Sea	PLN 595,200	Within the framework of the project, an agreement was signed for co-financing through the use of financial engineering for OP PO Fisheries and Sea of PLN 300,000, and the Provincial Fund for Environmental Protection and Water Economy of PLN 295,000. Within the implemented activity, boats with boat trailers were purchased for the District Police Headquarters Kamień Pomorski and the District Police Headquarters Goleniów. The activities included also activation of young people at the age of up to 18 years, meetings of children and young people regarding prevention with respect to counteracting poaching and purchase of equipment, environmental prevention and promotional activities.

7 http://www.funduszeeuropejskie.gov.pl/.

No	Programme	Project value	Project scope
2.	Operational Programme Infrastructure and Environment	PLN 2,360,000	An agreement for improving energy efficiency of Police buildings in the West Pomeranian Province, including the Police Headquarters Lipiany, the Police Headquarters Barlinek, the Police Headquarters Dębno, the Police Headquarters Wolin, the Police Headquarters Szczecin Dąbie.
3.	European Territorial Cooperation Poland Mecklenburg Brandenburg 2014–2020	PLN 1,442,000	A project for improving road traffic safety in cross-border communication routes of the West Pomeranian Province and Mecklenburg-Western Pomerania. Within the project, a purchase was made of passenger cars, the opening conference was organized, conference materials were purchased.
4.	European Territorial Cooperation Poland Mecklenburg Brandenburg 2014–2020	PLN 1,200,000	The programme pertained to monitoring water areas of the West Pomeranian Province and Mecklenburg-Western Pomerania. The project consisted of the cooperation between the water police of Mecklenburg-Western Pomerania and the Maritime University. Within the project, an R1 boat, a boat trailer, a night-vision device were purchased, exchange of experience took place as well as numerous promotional activities with respect to ecological behaviour in water areas of the West Pomeranian Province.
5.	European Territorial Cooperation Poland Mecklenburg Brandenburg 2014–2020	EUR 997,000	A project entitled "Correlation and Identification and Combating Cross-border Terrorist Links in the Field of Genetic and Information Technology Research." Within the project, a purchase was made of a sequencer and other equipment for the forensic laboratory, as well as reactivation occurred of the computer lab in the forensic laboratory. A simulation exercise was executed of a terrorist attack, as well as numerous workshops and exchange of experience regarding DNA testing as carried out.
6.	European Territorial Cooperation Poland Mecklenburg Brandenburg 2014–2020	PLN 125,000	Within the Small Project Fund, an application was submitted and settled by the Department of Social Communication: "Polish-German Regional Cooperation within the Scope of Building the Image of the Police and Intensification of Cooperation of Police Units to concerning Social Communication."
7.	European Territorial Cooperation Poland Mecklenburg Brandenburg 2014–2020	PLN 130,000	Within the Small Project Fund, an application was submitted entitled "Cross-border Procedures of Cooperation of Police Units within the Area of Operation of the Pomerania Euroregion." Within the project, activities were executed of cross-border observation, a 3-day workshop in administration of first aid, a purchase was made of promotional materials.

No	Programme	Project value	Project scope
8.	European Territorial Cooperation Poland Mecklenburg Brandenburg 2014–2020	PLN 130,000	Within the Small Project Fund, intensification occurred of activities of the services with respect to prevention of terrorism. The following were executed: soft activities, workshops, exercise, a purchase of multimedia equipment. The project was dedicated to the Independent Counter-terrorism Police Subdivision Szczecin.
9.	European Territorial Cooperation Poland Mecklenburg Brandenburg 2014–2020	PLN 42,000	Within the Small Project Fund, "#Multimedia – as Intensification of Police Services," a summary occurred of the hitherto cooperation within the confines of projects implemented together with the German partner. A conference was executed and a purchase was made of calendars.
10.	European Territorial Cooperation Poland Mecklenburg Brandenburg 2014–2020	PLN 120,000	The project "Cross-border Procedures of Cooperation of Police Units in the Pomerania Euroregion." The project was dedicated to exchange of experience for the department of operational techniques.
11.	European Territorial Cooperation Poland Mecklenburg Brandenburg 2014–2020	PLN 120,000	The project within the area of cooperation of police units of the West Pomeranian garrison of the Police and Mecklenburg-Western Pomerania. It pertained to elimination of terrorism by joint exchange of experience. The project was executed by the Independent Counter-terrorism Police Subdivision.
12.	European Territorial Cooperation Poland Mecklenburg Brandenburg 2014–2020	PLN 120,000	Polish-German regional cooperation with respect to building the image of the Police and contacts with external entities, the project was dedicated to the Department of Social Communication.
13.	European Territorial Cooperation Poland Mecklenburg Brandenburg 2014–2020	PLN 120,000	"Synergy of Units of the Polish and German Police for the Purpose of Ensuring Security within the Cross-border Region." The project was dedicated to the Riot Police Units. Joint activities, interventions, workshops, simulations of threats that may occur within the cross-border region.
14.	European Territorial Cooperation Poland Mecklenburg Brandenburg 2014–2020	PLN 120,000	"Intercultural Training for Police Officers of the Cross-border Region." The project was dedicated to the Department of Social Communication: intercultural training, workshops in the scope of communication.

No	Programme	Project value	Project scope
18.	Operational Programme Infrastructure and Environment	PLN 842,000	Improving the energy efficiency of Police buildings: preparation and carrying out audits – thermo-modernization of the facilities of the police station Świnoujście Warszów, the Provincial Police Headquarters Wernyhory facility, the Police Headquarters Chojna (documentation).

Source: own elaboration based on information from the Provincial Police Headquarters departments.

Supervisory requirements for European funds

Taking economic and organizational decisions, every unit takes account of the economic conditions of its operation. The economic background of the operation, within organization management, refers to being guided by free choice every time, based on risk assessment, regarding the materialization of positive and negative effects of the decision-making process and its outcomes. According to the provisions in force of the Act on public finance as contained in Art. 44 thereof, the public expenditure shall be made:

1. Purposefully and economically, subject to the principles of:
   a) obtaining the best effects from given outlays;
   b) optimal selection of methods and means serving to achieve intended goals.
2. In a way enabling timely execution of tasks.
3. At amounts and within time limits resulting from commitments and liabilities as previously made and incurred.

Public finance sector units conclude contracts whose subject matter is services, supplies or construction works, on the principles laid down in the provisions of the public procurement law, unless separate regulations provide otherwise.

The Police, as an institution of public trust, irrespective of the obligation to comply with the applicable regulations regarding public finance, must provide for openness and transparency concerning financial needs, expenditure made and reporting. Public finance sector units execute tasks within the powers as conferred thereto in line with applicable law. In order that every expenditure made by the Provincial Police Headquarters in Szczecin from public funds, including European ones, could be recognized as an economical expenditure, made in a purposeful, economical, reliable and adequate, any expenditure to have been incurred must be verified and a given expenditure group must be recognized as fulfilling the required assumptions. The fulfilment of the requirements refers to the qualification and inclusion of a given expenditure group with respect to the required definition. Definitions serve to give names clarity and distinctiveness. They are the subject of scientific research or a beginning on the road to further research. In case of an opinion being executed, one should define the required notions, as presented in the below table (4).

Table 4. Notions providing determinants evaluated with respect to the use of European funds

Notions determining areas of evaluation of internal audit	Explanation	Most important determinants under scrutiny
Legality	Means compliance with laws and regulations. Authorities are obligated to act within the limits and based on the law and may not refuse to perform tasks as entrusted thereto on behalf of the state.	Compliance Regularity Lack of omission
Economy	Includes a study of the efficiency of the use of the funds; the criterion of economy refers to the evaluation, during the execution of an audit task, of the optimal disposal of the financial means and materials and the optimization of the organizational measures being applied.	Efficiency Use Economy
Purposefulness	Refers to ensuring compliance of the activity of an audited unit with the goals being defined for the same. The study is to provide for the optimization of the methods and means being applied, their adequacy for the achievement of the goals as assumed, as well as their measurement.	Optimization
Reliability	Means diligence and conscientiousness. Evaluating reliability, one examines the performance of the entrusted tasks, the observance of the internal procedures of the functioning of a given unit, the documentation of specific activities or states of fact in an appropriate form and within required time limits, so as to enable generation of comparable and reliable reports.	Due diligence Conscientiousness Timeliness
Clarity	Means determination of the responsibility of the people who administer public resources, easiness to notice mismanagement and mitigation of the risk of inexpedient expenditure of public funds.	Accuracy Clarity Intelligibility
Openness	Refers to situations when institutions appointed to examine and evaluate the functioning of a unit have free access to data regarding public fund management.	Transparency

Source: own elaboration on the basis of A. Kubik, *Kontrola finansowa i audyt wewnętrzny – efekt procesu integracji z Unią Europejską oraz zintegrowany system gwarancji właściwego funkcjonowania jednostek sektora finansów publicznych*, in: *Kontrola i audyt w perspektywie europejskiej*, Conference of the Ministry of Internal Affairs and Administration, Warszawa 2004, pp. 167-169.

European funds as ones included in the state budget must be subject to required risk assessment mechanisms and obligations regarding the management control system. The need to supervise expenditure, as made, in a public finance sector unit is obvious. It results from the pursuance to ensure the fulfilment of public functions by the execution of goals and tasks as set. Management control in the Police has been introduced based on Art. 68 of the Act on public finance, in which its notion has been defined as the aggregate of activities undertaken in public finance sector units to ensure the execution of goals and tasks in a way as consistent with the law, efficient,

economical and timely. The basic element of the aggregation of the supervisory system is management control.

The goals of management control have been defined in Art. 68 of the Act on public finance and refer to the provision, in particular, for the following:

- compliance of the activity with the law and the internal procedures,
- effectiveness and efficiency of the activity,
- credibility of reports,
- protection of the resources,
- observance and presentation of the principles of ethical behaviour,
- effectiveness and efficiency of the information flow,
- risk management.

The conceptual range of management control and the systemic approach of management control to the processes of managing a public finance sector unit, as identified through the prism of goals and tasks of the unit, brought about a need to include in the control system all processes being executed in the unit. One of the essential processes that require filtering through the prism of the goals of management control is the process of expending European funds.

Management control in public finance sector units comprises an aggregate of activities undertaken to ensure execution of goals and tasks in a way as consistent with the law, efficient, economical and timely.[8] The management control of the process of the use of European funds should be designed and implemented in a way adequate for the requirements of Art. 68 of the Act on public finance, taking account of the management control standards introduced by the communication of the Minister of Finance regarding management control standards for the finance sector.[9] The monitoring, as implemented, of management control goals in the area of European fund expenditure should provide for updated and detailed access to knowledge at every level of organization management with respect to identification of positive and negative risks related to the use of European funds. The table below presents tasks executed at required levels referring to the management control system (5).

8 See Art. 68 Sec. 1 of the Act of 27 August 2009 on public finance.

9 Communication No 23 of the Minister of Finance of 16 December 2009 regarding management control standards for the public finance sector (Official Gazette of the Minister of Finance of 2009 No 23, Item 84).

Table 5. European fund management control mechanisms at the Provincial Police Headquarters in Szczecin

Stage of activity	Implementing units	Purpose of management control activity	Use of data and supervision of management control system
expressing an opinion on assumptions, priority axes and guidelines for creating programmes, as prepared by the managing authority	the Support Fund Team, the Financial Department and respective departments of the Provincial Police Headquarters in Szczecin	triggering effectiveness and efficiency of activities aiming to introduce into the assumptions being created issues regarding internal security and planned actions enabling acquisition by the Police of the status of a potential beneficiary of the programme in the future	the aim of management control is coordination by the Deputy Commander of the integration of the needs of the Police in the context of legality, purposefulness, effectiveness and efficiency of being granted funds in the future and access to information through the aggregation of required reporting data
ongoing monitoring of opening programmes enabling acquisition by the Police of European funds	the Support Fund Team.	increasing the quality of information flow regarding active programmes to verify the possibility of applying by the Provincial Police Headquarters in Szczecin. Analyzing possibilities of cooperation concerning the submission of a project of respective police services or the police and external entities	information as supplied from the management control system will enable to aggregate data and supervise task assignment to working groups, organizational units and employees
preparation of applications by the Provincial Police Headquarters in Szczecin	the Support Fund Team/respective departments/external entity	monitoring of activities being executed aiming to prepare project documentation and its submission with the competent managing authority	supervision of data integration from various organizational units. Coordinating the quality, timeliness of the application being submitted
activities aiming to execute the agreement	the Support Fund Team/respective departments/external entity	provision of all required documents as necessary to execute the agreement, including reporting data. Providing for property and information flow security at the level of the Police	data provided from the management control system enable supervision of the preparation of the application

Stage of activity	Implementing units	Purpose of management control activity	Use of data and supervision of management control system
selection of the contractor	the Support Fund Team, the Public Procurement Team or an external entity and respective members of the awarding committee from the Provincial Police Headquarters in Szczecin. Attorneys-at-law	taking care that public procurement principles are observed, particularly through the prism of compliance with the principles of ethical behaviour, procurement procedures, maintaining independence and objectivity	supervision of the procedure. Taking care of the transparency of the procedures
implementation of the project	the Support Fund Team, respective units, mostly procurement and investment as well as human resources and training	provision of information with respect to content-related, financial and material performance of the assumptions and requirements of the project	on-going evaluation of the implementation of the project.
project settlement	the Support Fund Team, the Financial Department and respective units	executed in real time, scoring of the fulfilment of project requirements concerning the achievement of the project goal, required indicators, as well as the correctness of financial settlements	ability to identify, on an ongoing basis, threats and correct these at the level of the unit management or preparation of space for submission of additional applications to the managing authority
project durability	The Support Fund Team, respective units and utilizing units	monitoring of the achievement of indicators – the quality of reports	identification of required elements obtained as a result of the execution of the project with respect to which there is the obligation of periodic maintenance by the financed unit
summary of the project and evaluation of conclusions and experiences to systematize knowledge for the future	all organizational units and police units taking participating in the project at each stage of the same	reporting as regards real effects of the project, information flow, risk analysis, summary	obtaining invaluable material of practical experience, enhancement of the organizational capabilities of the unit, know-how for the leadership of the unit

Source: own elaboration based on information from the Provincial Police Headquarters departments.

Conclusion

The need for security is particularly essential. Security is a state, or process, that safeguards the existence of an entity and its prospects for development. It gives a sense of certainty of one's existence and guarantees its maintenance and opportunities for improvement. It is one of the basic needs of the human being. It is characterized by being free of the risk of losing something particularly valuable for an entity: life, health, work, respect, feelings, tangible and intangible assets. Security is the primary need of the human being and social groups, it is also a basic necessity of states and international systems; its lack provokes anxiety and sense of danger. A human being, a social group, a state, an international organization try to influence its external environment and inner sphere to remove or at least move away, threats, thus eliminating one's own fear, concerns, anxiety and uncertainty. Threats may be directed inwards or outwards and such should be actions aiming to eliminate the same.

European funds, as tools supporting operations of the Police in the field of public security, should have a positive impact on the development of the Member States of the European Union. Their expenditure should be directed to such projects that will ensure, today and in the future, a durable effect of their use. European funds also serve the execution of the functions of the Police. Their specific character and the rules of acquiring, use and settlement of the same require that detailed control mechanisms be provided for their proper allocation.

The introduction of detailed control mechanisms regarding EU funds may not be executed in a public finance sector unit without the implementation of a management control system. Implementation of the management control system in the field of expenditure of European funds will contribute to the strengthening of supervision of the correctness, purposefulness and legality of their expenditure and achievement of the durability of every project.

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THE LEGAL SYSTEM OF POLAND AND GERMANY

THE MODEL OF THE POLISH CRIMINAL PROCEDURE. AN ANALYSIS FROM THE PERSPECTIVE OF ITS STRUCTURE AND THE FORM OF PROCESS FUNCTIONS AND PROCEDURAL GUARANTEES

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This paper is devoted to the model of the Polish criminal procedure concerning offences prosecuted *ex officio* within the basic variant, i.e. leaving aside the specific character of the so-called special procedures, in particular the expedited and private prosecution procedures. The outlined model has a legalistic underpinning, whereas the central role in criminal prosecution is performed by law enforcement agencies and determining authorities; thus the general characteristics of the model will disregard the issues of the so-called subsidiary indictment – referring to an exceptional system where, in regard to offences prosecuted *ex officio*, criminal prosecution has been abandoned (by refusal to initiate proceedings or discontinuance of the same) twice at the preparatory stage of a criminal proceeding, which, based on Polish legislation, opens the way for the aggrieved party to lodge a subsidiary complaint and pursue the criminal prosecution function, so to say, in place of the prosecuting attorney. From the methodological point of view, it will be expressed as a model representing a certain theoretical vision in the act currently in force – the Code of Criminal Procedure.[1] A proper reconstruction of the model requires that assumptions be considered which describe: the system of the sources of law, the guarantee-corrective procedural standard, the aspect of stadiality, the system of principles determining the form of respective stages, the position of the parties in the proceedings and their relations towards the process bodies.

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1 See J. Dąbska, *Dwa studia z teorii naukowego poznania. O metodzie analizy*, Poznań 1962, p. 22 et seq.

The system of the sources of law and the guarantee-corrective standard

The system of procedural criminal law in Poland is based on the model of statutory law. The basic legal act regulating the course of the criminal procedure is the Code of Criminal Procedure – the act of 6 June 1997[2], that is a legislative act which has been in force for 24 years, as amended repeatedly during its period of validity. Only about 40 percent of the provisions of this code are binding in the form in which they were enacted in its original wording. Apart from the code, as referenced, legal acts regulating the course of the criminal procedure are the Constitution of the Republic of Poland of 1997 and acts of international law that are binding on Poland (e.g. the Convention for the Protection of Human Rights and Fundamental Freedoms ratified by Poland on 19 January 1993, whereas the declaration of recognition of the jurisdiction of the European Court of Human Rights was submitted on 1 May 1993).[3]
In addition, the formation of the model of the Polish criminal procedure relies on implementing provisions, it is regulations issued based on statutory delegations contained in the CCP [*the Code of Criminal Procedure*].[4] Certain legal and systemic acts are also of some importance, especially ones defining the jurisdictional bases for the criminal process bodies and certain other participants therein (e.g. expert witnesses, probation officers).
Although the Polish system is a statutory law system, characterized by a hierarchy of the sources of law, it is also shaped by judicial decisions to a certain extent.
Such an influence is exerted in a direct manner by rulings of the Constitutional Tribunal; wherein one may mention that the so-called limited and interpretative judgements[5] prescribe the adoption of a specific interpretative result of the construction of provisions contained in the Code of Criminal Procedure so as to ensure the conformity of this result with the Constitution of the Republic of Poland – which

2 Consolidated text: Journal of Laws 2021, Item 534.

3 Journal of Laws 1993, No 61, Item 284. The recognition by the Government of the Republic of Poland of the jurisdiction of the European Commission on Human Rights (now obsolete) and the European Court of Human Rights, opened the way for lodging individual complaints which, as a consequence, affected the level of procedural criminal law guarantees. On 26 July 1994, Poland ratified Protocols No 1 and 4, and on 18 October 2000 – Protocol No 6, whereas on 4 November 2002 – Protocol No 7 (besides, it ratified Protocols No. 2, 9 and 11, pertaining to procedural issues).

4 E.g. the ordinance of the Minister of Justice of 22 September 2015 on bodies authorized beside the Police to conduct investigations and bodies authorized to bring and support indictments before the court of first instance in cases in which the investigation has been conducted, as well as the scope of matters assigned to these bodies, issued based on the statutory delegation contained in Art. 325d of the CCP; consolidated text: Journal of Laws 2018, Item 522.

5 See J. Mikołajewicz, "Orzeczenia zakresowe i interpretacyjne Trybunału Konstytucyjnego jako przejaw kryzysu legitymizacji legalnej", in: J. Oniszczuk (ed.), *Normalność i kryzys. Jedność czy różnorodność. Refleksje filozoficzno-prawne i ekonomiczno-społeczne w ujęciu aksjologicznym*, Warszawa 2010, *passim*.

de facto may mean a restriction on the scope of the instruction of a legal regulation (the so-called limited judgements).

An indirect influence on the interpretation of procedural law is exerted by judicial decisions of the Supreme Court and common courts (creating certain models for interpretation of regulations – particularly worth emphasizing is at present the concept of the so-called dispersed constitutional review performed by common courts within the application of judicial law).[6]

A weighty role is performed by European court and tribunal rulings; judgements of the European Court of Human Rights have been crucial for raising procedural standards for nearly 20 years. The rulings of this body have a two-way influence. For, on the one hand, it acts on a *casu ad casum* basis in the corrective aspect (the Court's judgements are, therefore, material on the plane of application of procedural criminal law), on the other, these rulings take effect at an abstract level, being taken into account within the framework of interpretation of legal regulations, as well as modelling the process of creating procedural criminal law. Judgements of the CJEU have affected the interpretation of procedural criminal law particularly after 2014, with a significant emphasis on the year 2018. In brief, the fact that the Republic of Poland is a member of the Council of Europe and subject to the jurisdiction of the European Court of Human Rights is of considerable importance from the point of view of the level of procedural criminal law guarantees. For, inasmuch as the procedural model adopted on the ground of Polish legislation may differ from other European countries' models, the guarantees resulting from the fair trial standard, the right to a fair trial, the right to defend oneself and the scope of protection of victims in criminal proceedings to have been worked out in the ECHR's decisions, co-shaping the model, have a clearly corrective effect. Therefore, a legislative solution included in the Polish CCP of a relatively low level of guarantees, subjected to adequate interpretation, particularly taking into account the constitutional aspect, as well as the conventional one (e.g. the so-called Strasbourg standards), enables reconstruction of fully guaranteed rules of procedure.

The model of the Polish criminal procedure is also influenced by regulations contained in EU directives. These regulations are not only implemented into the Polish legal system – modifying directly the content of a code regulation, but also, in relations to the concept of the so-called legal effects of unimplemented directives, formed in the doctrine under the influence of the decision of the Luxembourg Court of Justice, may, to some degree (even as unimplemented legislation, within a time limit set for Member States, that is following its ineffective expiry), affect the process of application of procedural criminal law.

6 See: P. Kardas, M. Gutowski, "Sądowa kontrola konstytucyjności prawa", *Palestra* 2016, Vol. 4, p. 5 et seq.

The stadiality and course of the procedure

From the structural point of view, the Polish model of criminal procedure is formed as a two-stage one. We can distinguish a distinct pretrial (preparatory) stage and a jurisdictional stage (two- or even three-stage one).

The preparatory stage

The full form of preparatory proceedings is the probe which, due to the so-called objective respects, is conducted first of all in cases of felonies and the most serious misdemeanours. In subjective respects, on the other hand (that is irrespective of the legal classification of an act being the basis for the initiations of the proceedings), it takes place because of the status of an entity being the suspect (an entity having the status of a judicial or prosecution authority official), or when, *in concreto*, a prosecutor considers this form as substantiated given the importance or complexity of a case. A less formalized, rigorous form of preparatory proceedings is the investigation. It is intended for a majority of misdemeanours, especially ones that carry a penalty of imprisonment not in excess of 5 years; with respect to offences against property: only when the value of the subject of the offence or the damage caused or imminent does not exceed 200 thousand zlotys. Both the probe and the investigation have the status of autonomous forms, which means that an investigation does not become absorber by the probe, e.g. as a result of the specific duration of the former being exceeded.
The model of preparatory proceedings has been based on the following principles: legality, action (prosecution) *ex officio*, material truth, external secrecy and restricted internal openness, domination of the principle of the written form.[7] In case of the last one (the written form), one should note that actions pertaining to the course of preparatory proceedings are primarily performed in writing, e.g. drawing up of a decision to initiate a probe/investigation, drawing up of a decision to present charges, drawing up of a principal action following the closing of preparatory proceedings, decisions and orders regarding evidentiary issues (only in the so-called urgent cases, as well as within an investigation, deviations are possible from the rule). Evidentiary proceedings are subject to minuting, and sometimes audiovisual recording.

The principles shaping preparatory proceedings are determined by the goals of these proceedings, comprising:

– establishment whether there is a factual basis to initiate the conduct of the proceedings (including determination whether a prohibited act has been committed and whether it constitutes an offence),

7 As regards an analysis of the system of rules, see e.g.: M. Cieślak, "Polska procedura karna. Podstawowe założenia teoretyczne", in: M. Cieślak (ed.), *Dzieła wybrane*, Vol. II, Kraków 2011, p. 157 et seq.

- necessary to materialize criminal liability – which is of individualized in nature – detection and, if need be, capture of the perpetrator and collection of indispensable data of his/her person, data determining procedural issues,
- execution of the principle of material truth (assuming that the establishment of facts of the criminal process bodies are to be consistent with reality) and the accurate criminal response directive, for which it is necessary to clarify the circumstances of a case, as well as to collect, safekeep and record, to the extent as necessary, evidence for the court,
- necessary consideration in preparatory proceedings for the aggrieved party's legitimate interests, which is contingent on the identification of injured persons and the extent of damage.

The basic body of preparatory proceedings is the public prosecutor. According to the assumption as made by the legislators, the prosecutor conducts (a probe) or supervises preparatory proceedings (a probe and an investigation), whereas, to the extent as provided in the act, the preparatory proceedings are also conducted by the Police and other bodies, e.g. the Border Guard, ISA (the Internal Security Agency), NRA (the National Revenue Administration), CBA (the Central Anticorruption Bureau), the Military Gendarmerie. Investigations, on the other hand, are conducted by the Police and the other uniformed services or other authorities within the scope of their respective competences (the Trade Inspection, the State Sanitary Inspection, President of the Office of Electronic Communications).

The prosecutor is the primary body involved in the probe, certain activities of this procedure have, however, been reserved as the exclusive competence of the prosecutor. In a probe, these are, first of all, the so-called dynamizing activities.[8] It is the prosecutor who has the authority to issue a decision to initiate a probe, a decision to present charges to the suspect, as well as a decision to close the probe. Individual activities, as well as entire sets or sequences of the same, can be entrusted by the prosecutor to the Police (or other authorities within the scope of their respective competences). The prosecutor, however, always takes decisions as to the course of the probe: he/she issues or approves decisions on refusal to initiate or discontinue, as well as to suspend, a probe.

The prosecutor's supervision of preparatory proceedings conducted by means of an investigation mostly assumes the form of an *ex post* supervision (which may be considered as lacking enough guarantees). Thus, it is limited, depending on the conclusion of preparatory proceedings, to the approval of a decision to abandon criminal prosecution (by refusal to initiate the investigation or discontinuance of the same),

8 See: B. Janusz-Pohl, *Formalizacja i konwencjonalizacja jako instrumenty analizy czynności karnoprocesowych w prawie polskim*, Poznań 2017, p. 220.

the complaint review of a decision to discontinue the case and enter it into the register of offences, as well as the approval of a draft indictment to have been drawn up in the investigation.[9]

It needs to be emphasized clearly that nobodies authorized to conduct preparatory proceedings are simultaneously entitled to act as a prosecuting attorney before a criminal court, whose action, at the first stage, consists exactly in bringing a principal action to the court. On this basis, criminal prosecution bodies which are authorized to conduct preparatory proceedings ought to be distinguished from ones that are, in addition, competent to bring an action to the court. The Police – one of the main bodies in preparatory proceedings – have not been vested with prosecuting functions in the criminal procedure (they are only competent to lodge an application for punishment in minor offence cases); likewise is in case of the other uniformed services (e.g. ISA, CBA). The problem of prosecutorial competences is, in any case, much more complex, especially with respect to bodies authorized to conduct investigations.[10] For the mosaic of prosecuting attorneys in this form is abundant. The Polish lawmakers have not adopted a model of the court's full control of preparatory proceedings in the variant of and examining magistrate or an investigating judge, providing, however, for the court's competence to conduct and also to exercise the complaint review over major procedural acts (conducting certain evidentiary proceedings, e.g. certain hearings, waivers of privilege in case of some legally protected secrets, application of pre-trial detention). A criminal court is also the control authority as regards a decision to abandon criminal prosecution – the court competent to examine the case is authorized to do so.

Therefore, in view of the goals as programmed for preparatory proceedings, it may be concluded that the pragmatically determined limit for the operation of the process bodies is, first of all, the execution of the prosecuting function. It is given priority. Criminal prosecution bodies, as public authorities bound by the principle of the rule of law, as defined in Art. 7 of the Constitution, must also – to the extent as necessary – take into account any legally protected interests of the parties to the proceedings,[11] and more precisely:

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9 See: J. Tylman, "Model procesu karnego a nadzór nad postępowaniem przygotowawczym", in: P. Kardas, T. Sroka, W. Wróbel (eds.), *Państwo prawa i prawo karne. Księga jubileuszowa Profesora Andrzeja Zolla*. Vol. II, Warszawa 2012, Lex/el.

10 See: J. Skorupka, "Prosecutor's image after the amendment of criminal procedure code in 2016", *Ius Novum* 2018, Vol. 2, p. 107 et seq.

11 See B. Janusz-Pohl, 'Dyrektywa umiarkowanego formalizmu czynności procesowych a teoretyczno-prawna koncepcja formalizacji', in: D. Gil (ed.), *W kierunku odformalizowania procedury karnej. Perspektywa a rzeczywistość*, Lublin 2017, p. 643 et seq.

a) the active party, that is the aggrieved (the position of this party pertains to the directive of allowing for the injured party's interest, respecting the dignity of the victim of an offence and adequate execution of the principle of procedural loyalty);
b) the passive party: the suspect, whose position is defined by the principle of the right to defend oneself, including the guaranteed right to active defence and passive defence (the so-called right to silence), the principle of presumption of innocence, the *in dubio pro reo* rule and the principle of procedural loyalty.

In preparatory proceedings, the aggrieved is a *de iure* party to the proceedings, it becomes one upon the initiation of preparatory proceedings, when it can be considered as an entity (a natural or juridical person, or an organizational unit having capacity to be a party to court proceedings), whose legal interest has been jeopardized or infringed on by an offence. Therefore, aggrievement is determined by a hypothesis, as adopted, of a prohibited act where to criminal proceedings are initiated.[12] It needs to be emphasized that the hearing of a person in his/her capacity of the aggrieved party does not have a creative power in this respect, but only a declaratory one. The aggrieved party is a party to preparatory proceedings irrespective of being heard as the injured in the preparatory proceedings. Certainly not in every variant of the criminal procedure, this being dependent on the punishable prohibited act, there will appear an aggrieved party (one may, in this context, distinguish the so-called no-victim offence category, that includes crimes consisting in an abstract threat to a legal interest, e.g. driving a motor vehicle in a state of intoxication). In some cases, the legislators have authorized an entity, usually the aggrieved party, to initiate criminal prosecution, making the admissibility of instituting proceedings dependent on lodging a pertinent application for prosecution (it is the so-called application mode). Whereas, an application for prosecution is an impulse for the process bodies which, having such an application been lodged, proceed by virtue of their office, that is *ex officio*. Procedural configurations are also possible within which a very numerous group of injured persons appears in preparatory proceedings. These diverse states of fact affect directly the shaping of the procedural position of the aggrieved party – they influence the lawmakers' decision, as the latter cannot (bearing in mind the effectiveness, efficiency of the preparatory proceedings) meet, given vesting *ex lege* the aggrieved party with the status of a party to preparatory proceedings, the demands of *de lege ferenda* postulates, as resulting from the directive of equality of arms. Thus, the rights of the aggrieved party to preparatory proceedings are not equivalent to the rights of the suspect (e.g. Art. 321 CCP).

The status of the passive party at the preparatory stage is formed quite otherwise. The Polish legislators have assumed a formal, not a material, variant of the definition

12 See: B. Janusz-Pohl, *Formalizacja…*, p. 232 et seq.

of the suspect. According to Art. 71 CCP, it is an entity (a natural person) with respect to whom a decision has been issued to present charges, as well as an entity who, without being issued such a decision, has been presented with a charge in connection with his/her interrogation in the capacity of a suspect. Hence, the status of a suspect is rendered by the taking of specific actions being an emanation of the prosecutorial function. What is more, such actions have a fully formalized character.[13]

It may be mentioned that only the formalization of the passive party actualizes the complete protection resulting from the principle of the right to defend oneself, the presumption of innocence and the *in dubio pro reo* rule. Such a state of affairs raises certain doubts. For it is unquestionable that within criminal proceedings, still in the forefield of the formation of the suspect as a party to preparatory proceedings (i.e. his/her formal position in the preparatory proceedings), the process bodies are authorized to undertake procedural acts that interfere with the sphere of constitutionally, as well as conventionally, protected rights and liberties (e.g. in the context of detention, subjecting one to an activity infringing upon the inviolability of the person, a search). On the ground of the Polish CCP, this entity is defined as a suspected person. Undoubtedly, such an entity is not a party to preparatory proceedings, it appears in the so-called *in rem* phase of the preparatory proceedings, since the Polish lawmakers have not adopted a material definition of the suspect – according to which a party to preparatory proceedings is an entity with respect to which acts have been undertaken that interfere with the sphere of rights and liberties, aiming at criminal prosecution of this entity. To put it briefly: the legal position of the suspect in the Polish doctrine and case law has been discussed widely, and opinions vary. I opt for the interpretative variant, according to which the lawmakers should maintain the formal definition of the suspect, whereas on the plane of application of law, the so-called suspected person should be covered by the guarantee of the principle of the right to defence, as originating in the Constitution of the Republic of Poland. The standard of the right to defence in regard to a suspected person has, therefore, a fragmentary character and refers to specific procedural acts undertaken with the participation of, or towards such an entity. Perhaps, in order to increase the scope of protection, it should be specified in more detail in the CCP – although, in my assessment, even on the ground of the present legal situation, its binding force ought to be considered as uncontroversial[14] (some doubts are, however, being raised by the

13 B. Janusz-Pohl, *Formalizacja…*, p. 236 et seq.

14 Ibidem. See: S. Steinborn, M. Wąsek-Wiaderek, "Moment uzyskania statusu biernej strony postępowania karnego z perspektywy konstytucyjnej i międzynarodowej", in: M. Rogacka-Rzewnicka, H. Gajewska-Kraczkowska, B. Bieńkowska (eds.), *Wokół gwarancji współczesnego procesu karnego. Księga jubileuszowa Profesora Piotra Kruszyńskiego*, Warszawa 2015, p. 447 et seq.

interrogation of a suspected person in connection with the entry into the Criminal Code of Art. 233 Para. 1a).

In the context of the passive party in preparatory proceedings, one must not forget the standard of formal defence. The issue seems to be regulated asymmetrically in the Polish criminal procedure as compared to a majority of European legislations.[15]A diagnosis may be formulated that Polish law provides for a slightly lower standard of formal defence, that is the right to representation by a defence lawyer. On the ground of Polish law, the suspect only has the right to such representation (without limitations), which means that he/she may appoint counsel consisting of a maximum of 3 lawyers to defend his/her rights (this appointment may be made by himself/herself, as well as by another person, so to say, in substitution of the suspect). If the suspect has an appointed defence lawyer, then the act safeguards the suspect's counsel's participation in his/her first interrogation (Art. 301 CCP). This means that the suspect has the right to counsel already upon becoming the party to the preparatory proceedings. Priorly, he/she can use the assistance of an attorney (the so-called suspected person's attorney which attorney has a special procedural status, among others, he/she must not be questioned in the capacity of a witness regarding circumstances that pertain to the representation of the detained person in the criminal proceedings; such an attorney is therefore covered by the defence lawyer's privilege). The legislators have also provided for a possibility to appoint the so-called public defender for the poor. According to Art. 78 CCP, the suspect, and at the court stage the accused, may demand that a public defender be appointed for himself/herself if he/she duly demonstrates that he/she is not able to afford the costs of the defence without detriment to the indispensable livelihood of himself/herself and his/her family. What is essential, a public defender may be appointed due to an economic circumstance also as a defence lawyer for the performance of a procedural act, not for representation throughout the proceedings. This right is of particular importance with respect to the taking of evidence in preparatory proceedings.

It needs to be emphasized, however, that the Polish legislators do not prescribe a uniform variant of obligatory defence for all suspects within preparatory proceedings. Obligatory defence at this stage is determined solely by the following circumstances:

a) the suspect's minority;
b) his/her disabilities in the form of deafness, muteness and blindness;
c) doubts as to the sanity at the time of committing the act (if there is a reasonable doubt as to the exclusion or substantial impairment of the suspect's ability to recognize the significance of the act or control his/her actions);

15 See M. Wąsek-Wiaderek, "Dual Legal Representation of a requested person in European Arrest Warrant Proceedings – Remarks from the Polish Perspective", *Review of European and Comparative Law* 2020, Vol. XLI, Issue 2, p. 35 et seq.

d) and also doubts as to the sanity in the course of the proceedings (there is a reasonable doubt whether the mental health enables the suspect's participation in the proceedings or conduct the defence in a self-reliant and sensible way).

The abovementioned bases of obligatory defence act identically at the jurisdictional stage, although the catalogue of obligatory defence bases at the jurisdictional stage is slightly broader.

At the preparatory stage, the formation of the process functions, i.e. the adjudication function, the prosecution function and the defence function, is not separable and symmetrical with respect to the parties of the process and the prosecution bodies, and in particular the body being *dominus litis* of this stage, that is the public prosecutor;in view of the fact that the latter cumulates the prosecution function and the adjudication function.[16]

The jurisdictional stage

The constitutional and conventional principle of the right to a fair trial, as well as the principle of judicial review – in the guaranteed two-instance model variant – affects the formation of jurisdictional proceedings. Abstractly speaking, the following may be distinguished within jurisdictional proceedings: the so-called interlocutory proceedings,[17] proceedings before a court of first instance (the main trial)proceedings before an appeal court (the appellate trial). The jurisdictional stage may also comprise court proceedings following final and valid decisions (ones having the force of *res iudicata*) by means of extraordinary means of challenge.[18] Restricting oneself only to the issue of judicial review – these are cassation proceedings, proceedings regarding a complaint against a cassation judgement of an appeal court, proceedings regarding reinstitution of court proceedings concluded with a final and valid court decision, as well as proceedings regarding the so-called extraordinary complaint,[19] as regulated in the Supreme Court Act.

Jurisdictional proceedings are based on the principle of complaints; depending on the stage thereof, they may be initiated by means of a principal action (in the form of an indictment and its substitutes), as well as a stage action: a complaint, an appeal, a cassation, a complaint against a cassation judgement of an appeal court, an extraordinary complaint and, in part, an application for reinstitution of court proceedings concluded with a final and valid decision (although the latter may also be initiated

16 See: B. Janusz-Pohl, *Formalizacja…*, p. 211 et seq.

17 See: A. Gerecka-Żołyńska, "Postępowanie sądowe przed rozprawą główną", in: P. Wiliński (ed.), *Polski proces karny*, Warszawa 2020, p. 505 et seq.

18 See: B. Janusz-Pohl, "Nadzwyczajne środki zaskarżania", in: P. Wiliński (ed.), *Polski proces karny*, Warszawa 2020, p. 655 et seq.

19 Ibidem.

ex officio). The principal action defines precise objective and subjective limits, constitutes an impassable programme for a criminal court; the binding of a court by a stage action is slightly lesser (e.g. a court may go beyond the limits of the remedy in the situations as clearly identified in the act, so: Art. Art. 433 and 436 CCP).

In accordance with the CCP, the court of first instance is the district court (Art. 24 CCP constitutes the presumption of the competence of a court of first instance – this court adjudicates in the first instance on all cases, to the exclusion of ones referred by the act to the jurisdiction of another court). By way of exception, the CCP refers the jurisdiction to examine cases in the first instance to the regional court (Art. 25 – these are all cases in which the preparatory proceedings have been conducted in the form of a probe). The court of appeal is the regional court which examines means of appeal against decisions of the district court, and the appeal court which examines means of appeal against first-instance decisions of the regional court. The Supreme Court examines cassations, complaints against a cassation judgement of an appeal court, as well as the extraordinary complaint.

Court proceedings in a criminal case must be materially and locally competent, impartial – these criteria are a component of the constitutional and conventional right to a fair trial.[20] Court proceedings are, as a general rule, open: both in its internal and external aspects (i.e. to the public).

Interlocutory proceedings are initiated by means of a principal action. The bringing of an action creates the state of pendency of the proceedings before the court, the interlocutory stage comprises the formal review of a complaint, as well as the substantive review.[21]

The substantive review is diversified in form, and within its framework it is possible for a criminal court to take decisions as to the substance of criminal proceedings. Beside the court's competence to issue decisions regarding: incompetence, suspension, discontinuance of proceedings, mode of prosecution, prolongation or revocation of the application of pre-trial detention, return of a case for supplementation of material deficiencies of preparatory proceedings; a criminal court has the right of the so-called judging in session. For as soon as at this stage, a conclusive completion of proceedings may take place as a result of the passing of an injunction judgement, a judgement in the so-called consensual mode, as well as a judgement regarding conditional discontinuance of proceedings. Thus, criminal proceedings before a court of first instance may be of a very limited (even vestigial) character. By means of this procedure, the legislators allow to abandon such key principles of court proceedings

20 See: Z. Kwiatkowski, "Right to a court in a democratic state ruled by law", *Ius Novum* 2012, Vol. 2, p. 33 et seq.

21 Under certain conditions, however, the prosecuting attorney's action may be withdrawn, see: R.A. Stefański, "Withdrawal of the indictment by public prosecutor", *Ius Novum* 2014, Vol. 2, p. 81 et seq.

as the principle of orality, the principle of openness (external) and, particularly, the principle of directness. The court passes a judgement in a criminal case on the basis of the case file (that is the evidentiary material prepared by the preparatory proceeding bodies) and the positions of the parties to the proceedings. As a general rule, the possibility of a conclusive completion of proceedings before the court of first instance at the court's sitting without holding a trial and, in this respect, having abandoned the conduct of evidentiary proceedings, is dependent on the prosecuting attorney's application (such an application is a necessary prerequisite for the passing of a judgement of conviction). The court – analyzing this issue *ex officio* – may discontinue criminal proceedings conditionally (in case of conditional discontinuance, it is, however, initiated by means of the prosecuting attorney's application) or pass an injunction judgement.

A consequence of the bringing of a principal action (apart from the creation of the state of pendency) are the parties to the proceedings being constituted: the active party of the prosecuting attorney and the passive party of the defendant. There are configurations that enable joint participation, therefore implying a multiplication of entities appearing both on the active and passive sides. Yet, it is only on the active side – the prosecuting one – that the status of joint participants is non-uniform. And so, in the public prosecution mode the main prosecutor is the prosecuting attorney, the entity which, at the preparatory stage, performed the role of the process body. The dominating prosecuting attorney is the prosecutor has previously acted as *dominus litis* of the pre-litigation stage. Such a variation of the process roles, their transitivity, as compared to the specificity of the formation of the public prosecutor's office in Polish law, bears certain problems.[22] The prosecutor, covered by the principle of impartiality of action at the preparatory stage (taking account of circumstances weighing in both in favour and against the suspect), becomes an entity acting unidirectionally (against the defendant) at the jurisdictional stage. The basic systemic problem relating to the prosecutor as a prosecuting attorney is his/her positioning as a prosecuting entity representing an entrusted interest which, by comparison with the principle of indifference of the public prosecutor's office, that is the, so to speak, "anonymity" of the prosecutor, is, in my assessment, one of the reasons for varying efficiency of prosecutorial actions. Such a state of affairs considerably disturbs the contradictoriness of court proceedings – for the obligation to conduct the evidentiary proceedings lies in fact with the court. A subsidiary auxiliary prosecutor may also appear on the prosecuting side, i.e. the aggrieved party who, until the moment of the opening of court proceedings at the main trial, has filed an application for being

22 See: R.A. Stefański, "Prokurator jako rzecznik interesu społecznego", in: C. Kulesza (ed.), *Strony i inni uczestnicy postępowania karnego, System Prawa Karnego Procesowego*, Vol. VI, Warszawa 2016, p. 1189 et seq.

admitted to fulfil prosecutorial functions. The regulations of the Polish CCP do not, therefore, guarantee that the aggrieved party be granted the position of a party at the jurisdictional stage.

A defendant who is a party to court proceedings is vested with a wide range of rights. A part of these have the status of independent rights: here, among others, the right to appear and participate in the trial, the right to be heard, the right to silence, the right to appoint counsel (wherein obligatory defence extends beyond the instances as referred to in Art. 79 CCP to include also a situation analyzed *in concreto*, for the court may decide on the necessity of the defence lawyer's presence due to circumstances that hinder the defence. The defendant must also have counsel in proceedings before the regional court, if he/she has been charged with a felony. The participation of a defence lawyer in a trial is obligatory. It need be added that the defendant has, in principle, the right to participate in the trial, unless the presiding judge or the court deem his/her participation obligatory. If, however, the defendant has been charged with committing a felony, he/she is obligated to take part in the first hearing so that the defendant's right to be heard may be materialized. The defendant has also a number of dependent rights, having the status of the so-called *favour defensionis*, these are established in order to counterbalance the position of the defendant being weaker in comparison to the one of the prosecuting attorney, as the noninstitutional party to the proceedings (e.g. the right to rebuttal, the right to the last word).

In the context of an analysis of the status of the parties to the proceedings, it may be noted that the formula of the principle of contradictoriness is limited. A court trial is based on the principle of orality, openness, relative directness (i.e. directness with a number of concessions in favour of indirect evidentiary proceedings), and its general formula accords with the contradictory variant. The latter, however, provides that the passive and active parties are in dispute before an impartial, yet very active, in the course of evidentiary proceedings, arbiter. This is so because a criminal court is equipped with full evidentiary initiative. Simultaneously, due to the fact that it is the criminal court which is bound by the principle of material truth, and therefore it is, among others, responsible for establishing the facts, with the concurring distribution of the burden of proof (by means of the *in dubio pro reo* rule); oftentimes the court's initiativeness in the course of the evidentiary proceedings significantly exceeds the parties' activity, including the one of the prosecuting attorney. Irrespective of the outlined tendency, it should be noted that a regulation was introduced into the Polish CCP in 2015 enabling private parties (the defendant, the aggrieved party acting as a subsidiary prosecutor) to present the court with the so-called private evidence,

i.e. evidence originating outside criminal proceedings and for its purposes.[23] This evidence assumes the form of private documents, more often than not being opinions of the so-called private experts; their procedural value is not equivalent to the one associated with evidence from the opinion of an expert witness (an entity appointed by a process body).

Proceedings before the court of first instance, the main trial in fact, can be full-scaled: an introductory part, court proceedings, the parties' closing arguments and the judging. They can also be reduced, i.e. by means of the shortening of the evidentiary proceedings at the trial, among others when the defendant files an application for the passing of a judgement of conviction without conducting evidentiary proceedings, which is a manifestation of procedural consensualism.[24] As a general rule, the opening of court proceedings at the main trial precludes (apart from the expedited procedure) resumption of the preparatory stage of the proceedings, that is the return of a case in view of material deficiencies to the prosecutor for supplementation of these deficiencies. It is only possible to perform the so-called supplementary evidentiary actions by the prosecuting attorney. Proceedings before the court of first instance are concluded with the judging, the sentencing, in fact. A judgement of the court of first instance is, as a general rule, provided with reasons thereof on the parties' application. The service of a copy of the judgement with the reasons commences the course of the 14-day time limit for filing an appeal, if any.

To put it briefly, the model of appellate proceedings is a reformatory one. A stage action – a complaint, is a necessary prerequisite for the initiation of these proceedings, outlines its framework (defining a direction of the adjudication, the scope of the examination, being relevant to the scope of prosecution and means of challenge; in principle, appeal complaints do not set the limits for the appeal, unless it comes from a legal professional: an advocate or an attorney-at-law). With respect to a party's filing of a means of challenge, the principle of *falsa denominatio non nocet* is of great importance. As already mentioned, an appeal court may, however, go beyond the limits of challenging and the complaints, as raised, first of all when a first-instance judgement is vitiated by the so-called absolute review defect. A directional, i.e. restricted to adjudicate only in favour of the defendant, departure beyond these limits may occur due to the fact that the appealed decision has been considered grossly unfair, the need to correct the legal classification in favour of the defendant, the reversal

23 So amended Art. 393 Para. 3 CCP in the form in force as of 1 July 2015, introduced by virtue of the Act of 27 September 2013 amending the Code of Criminal Procedure and certain other acts (Journal of Laws, Item 1247 as amended).

24 See: B. Janusz-Pohl, "Konsensualizm procesowy – rozważania w kontekście koncepcji tzw. norm poprawczych", in: S. Steinborn, K. Woźniewski (eds.), *Proces karny w dobie przemian. Przebieg postępowania*, Gdańsk 2018, p. 41 et seq.

of the judgement towards the co-defendants who have not filed an appeal in view of the occurrence of the so-called *gravamen commune*.

From the point of view of the general characteristics of appellate proceedings, it should be noted that the basis for an appeal may be complaints regarding exclusively:

a) breach of substantive law (following the last amendments, only breach of provisions of substantive law with respect to the legal classification of the act as ascribed to the defendant, or another breach of substantive law, unless, despite an erroneous legal basis, a decision complies with law);
b) breach of the rules of procedure, if the same might have affected the contents of the decision;
c) an error in the establishment of facts to have been assumed as the basis of a decision, if the same might have affected the contents of the decision;
d) gross disproportion of a punishment or another penal measure.

In addition, an appellate complaint may also comprise the so-called absolute complaint as specified in Art. 439 CCP. By way of a brief conclusion: not all breach of procedural law to have occurred within the criminal procedure is capable of influencing the contents of a decision.[25] These are only defects of jurisdictional proceedings, and not all of them, as well as breach of the conditions of the legality of evidentiary actions within preparatory proceedings, if they have not, or could not have, been validated in jurisdictional proceedings, and the decision as made has relied on such establishment of facts which has been based on the results of those defective actions (defective evidence). Breach of procedural law within the preparatory stage is, therefore, capable only to a marginal extent of penetrating into court proceedings and becoming the basis of an appellate review.

Appellate proceedings are reformatory ones. An appeal court is entitled to make a confirmatory decision – upholding the first-instance decision in whole, a reformatory one, amending, either in whole or in part, the first-instance decision, and in exceptional cases, an appeal court may adjudicate by means of a cassation. Simultaneously, the parties are entitled to a special complaint against a cassation judgement, having the status of a supervisory instrument.

Cassation, from the point of view of the course of the instance, is an extraordinary means of appeal. It occurs in two variants of the parties' cassation and the extraordinary cassation (the Commissioner for Human Rights, the Public Prosecutor General, the Commissioner for Children's Rights). In principle, these are two separate measures. The parties' cassation is vested in them against a final and valid judgment of the appeal court concluding the proceedings (that is a confirmatory or reformatory judgement). A party may bring a cassation (a means covered by compulsory

25 See: B. Janusz-Pohl, *Formalizacja…*, p. 565 et seq.

representation by a lawyer) in favour: exclusively in case the defendant has been sentenced to imprisonment without a conditional suspension of the sentence, and against: only in the event that the defendant was acquitted of the proceedings were discontinued. A special cassation, on the other hand, may be brought by authorized entities against every final and valid decision of the court concluding the proceedings. The parties may file a cassation only for by reason of the absolute defect of the decision under Art. 439 CCP, or another gross violation of law, if the same could have had an influence on the contents of the decision. A cassation may not be brought due to gross disproportion of a punishment – this last restriction does not pertain only to a cassation by the Public Prosecutor General. The list of cassation complaints is therefore much shorter than the one of appellate complaints. Cassation is a means of a very narrow scope, it allows to correct only a certain margin of defective decisions.[26]
By way of conclusion, the elements, as indicated, that define the model of the Polish criminal procedure, have only been characterized fragmentarily. Emphasis has been placed on certain selected features of this model, that enable to describe the same as a mixed one, contradictory to a little degree: an inquisitional-adversarial, with only an admixture of contradictoriness at the jurisdictional stage.
The superior goal of the criminal procedure in Poland is the execution of the directive of accurate penal response, that is the criminal process bodies' pursuit of detecting the perpetrator and holding him/her criminally liable, whereas an innocent person should not be held so liable. Criminal prosecution in Poland is based on the concept of substantive legality, on which ground a reasonable suspicion of an offence provides an impulse resulting in an obligation to react on the part of bodies which are not authorized to verify the appropriateness of criminal prosecution. Some signs of judicial opportunism can be diagnosed in the Polish system, these are, however, relatively limited. Even the variant of the so-called plea bargaining on the ground of the criminal procedure act currently in force assumes that a procedural decision taking account of the punishment or penal measures to have been negotiated by the parties within the proceedings may only be taken only when both the guilt and the circumstances of the case raise no doubts, and the objectives of the proceedings have been achieved. The lawmakers does not provide at present for any concessions as regards the sentencing and penal measures for perpetrators who have decided to initiate or co-participate in one of the consensual modes (aiming, *de facto*, only at the shortening and deformalization of the process). A certain threat in this respect in only associated with the institution of the application for the passing of a judgement of conviction as negotiated within the preparatory proceedings (Art. 335 Para. 1 CCP), at an early stage thereof – in view of the suspect's pleading guilty. For this institution

26 See: B. Janusz-Pohl, *Nadzwyczajne…*, p. 655 et seq.

enables limitation of evidentiary proceedings, hence using it may, d*e lege lata*, be of an opportunistic nature.

The Polish criminal procedure is undergoing constant transformations, a trend to be observed at present comprises changes aiming to expedite the course of the process, with a simultaneous increase of the inquisitional role of the court at the jurisdictional stage. Thus, the contradictoriness of court proceedings, which, in 2015, was the leading slogan of the then changes, is now in retreat.

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CRIMINAL PROCEEDINGS IN GERMANY

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This article presents an outline of criminal proceedings in Germany with regard to the role and objectives of criminal prosecution, legal basis, responsibilities of the prosecuting authorities and courts and explains the rights of the parties involved, in particular of the accused in this context.

Introduction

The state alone has the monopoly to enforce the claim to criminal justice claim against the offender resulting from the violation of criminal laws. The conditions that trigger criminal liability, the types of penalties and other measures linked to it are determined by substantive criminal law, which is enshrined in law in the German Criminal Code (*Strafgesetzbuch*, CC) and in ancillary criminal laws. Legal violations of a lesser degree of malfeasance from a policy perspective[1] are prosecuted and punished as a regulatory offence by administrative authorities.

Criminal procedure law defines the investigation and prosecution of criminal offences and is mainly regulated in the German Code of Criminal Procedure (*Strafprozessordung*, CCP), which stipulates the course of proceedings from the reporting of offences to the enforcement of judgments.

The most elementary provisions on criminal prosecution are already enshrined in the German Basic Law. Articles 101 et seqq. of the Basic Law outline the most important fundamental rights of justice, such as the prohibition of extraordinary courts, the right to have a case heard by the lawful judge, the prohibition of prosecuting

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1 Judgment of the German Federal Constitutional Court, BVerfGE 22, p. 78, at p. 81; BVerfGE 27, p. 18, at p. 28.

a person twice for the same offence ('double jeopardy') and the legal guarantees in the event of a deprivation of liberty. Together with the civil courts, the criminal courts form the ordinary jurisdiction; their jurisdiction, structure and composition are regulated in the Courts Constitution Act (*Gerichtsverfassungsgesetz*) and are essentially determined by the significance and severity of the offence and the expected duration of the prison sentence to be imposed. Furthermore, the Courts Constitution Act contains provisions on the appointment of lay judges, the structure and jurisdiction of the public prosecution offices organised in line with the criminal courts, as well as the legal framework for the investigating persons of the public prosecution office, which also include certain police officers.

The proceedings against juvenile and adolescent offenders are contained in the Youth Courts Act (*Jugendgerichtsgesetz*). The Act determines the structure of youth courts and special procedural rules that are based on the notion of education.

Mainsection

Objectives and role of criminal proceedings

Criminal procedure law has two functions, the objectives of which are competing with each other and mutually incompatible in individual cases; these must then be balanced against each other.

On the one hand, procedural rights should facilitate the investigation of a criminal act and the enforcement of the state's pursuit of criminal justice. The aim is to determine the truth ex officio in order to find a correct and just decision from a substantive and legal point of view.[2] This calls for a functioning criminal justice system[3] to which citizens are entitled, since they are forbidden on pain of penalty to avenge a criminal act themselves and they have only limited powers of participation in criminal proceedings.

On the other hand, the state must guarantee a fair trial based on the principles of the rule of law to protect the civil liberties of a possible offender against excessive, i.e. disproportionate, interference by the state. Hence, justice cannot be provided at any price[4] and in the event of a conflict between the responsibilities in individual cases, these must be balanced against each other, as both considerations apply to an equal extent. The proper production of a judgment in accordance with the rules of

2 W. Beulke, § 1 para. 3.

3 Judgment of the German Federal Constitutional Court,BVerfG 34, p. 238, at p. 248 et seq.; Judgment of the German Federal Court of Justice in: *JuristischeRundschau (JR)* 2016, p. 78.

4 Judgment of the German Federal Constitutional Court in: *JuristenZeitung (JZ)* 2011, p. 249, at p. 250; judgment of the German Federal Court of Justice in Criminal Matters, BGHSt 38, 215, at p. 219 et seq.

procedure is an equally important responsibility next to the requirement of an effective criminal prosecution.[5]

In the final instance, criminal proceedings serve to restore legal peace in regard to criminal culpability. The final and binding judgment prevails and may not become the subject of criminal proceedings in the same matter again (cf. Article 103(3) of the Basic Law). This blocking effect of a final and binding judgment protects the interests of both the individual and the general public. Only in cases of extreme injustice, the final and binding effect of a judgment may be reversed by reopening the proceedings.

The fundamental procedural principles of German criminal procedural law

The procedural principles have evolved over time and constitute the fundamental procedural rules that result from the Basic Law, the CCP and the Courts Constitution Act and the violation of which may lead to a ban on using evidence in criminal proceedings as they affect the core of the constitutionality of the proceedings.

Principle of public prosecution

is the principle of prosecution *ex officio* (section 152(1) CCP) and assigns the task of initiating and conducting criminal proceedings to the state alone (monopoly on the prosecution), regardless of the will of the aggrieved party; in this regard, criminal procedure law differs fundamentally from civil procedure law, which entrusts the responsibility for the enforcement of legal claims to the individual citizens. Exceptions only apply in the case of offences of lesser public interest (offences open to private prosecution, and offences that are prosecuted only based on a request to prosecute).

The principle of mandatory prosecution and the principle of investigation

lead as a consequence of the monopoly on the prosecution to the obligation to launch investigations when the prosecuting authorities have an initial suspicion that a criminal offence has been committed and to the obligation to file an indictment when this suspicion is confirmed (sections 152(2), 170(1) CCP). The obligation to prosecute and investigate is also incumbent on the police, section 163 CCP. Only the public prosecution office is entitled to waive the prosecution of a criminal act or the punishment of an offender if they deem it opportune. The prosecuting authorities are required to investigate the facts *ex officio*, establish the actual course of events (principle of material truth) and submit their findings to the court.

5 W. Beulke, § 1 para. 5.

Principle of indictment

authorises only the public prosecution office, which is independent of the criminal court, to file public charges against the accused before the competent court by a bill of indictment, section 151 CCP. In this way, the public prosecution office determines the scope of the proceedings, in particular the indicted accused, the alleged act and the applicable criminal provisions and thus ensures an unbiased ruling in the judicial instance.

The principle of free evaluation of evidence by the court

authorises the court to decide on the outcome of the evidence taken according to its free conviction gained from the hearing as a whole, section 261 CCP. Set rules of evidence that indicate when a fact is deemed to have been proven are fundamentally inconsistent with criminal law.

The principles of oral hearings and of publicity

provide in the interest of better comprehensibility by the accused and for a more effective monitoring of the criminal judicial process by the attending public (section 169 of the Courts Constitution Act) that the entire case must be addressed in the main hearing (section 261 CCP). The judgment may only be based on what has been heard by all parties involved.[6] In principle, anyone may attend criminal proceedings; proceedings may be held in camera for weighty reasons only.

The presumption of innocence

takes into account the principle of the rule of law under Article 20(3) of the Basic Law and requires that the culpability of the defendant be proven in court in accordance with proper proceedings compliant with the procedural rules and that the court be persuaded of the defendant's culpability. If the adjudicating court has objectively justified doubts about the culpability of the defendant, the defendant must be acquitted in accordance with the presumption of innocence (*in dubio pro reo* – in case of doubt, for the defendant). This principle of the benefit of doubt also applies to procedural requirements but not, according to the prevailing opinion, to other procedural errors.[7]

6 W. Beulke, § 2 para. 23.

7 Judgment of the German Federal Court of Justice in Criminal Matters, BGHSt 16, p. 164, at p. 166.

The principle of acceleration

means that the accused must obtain clarity about the criminal charges filed against them and that the proceedings must be carried out as quickly as possible, in particular when the accused is detained (as derived from Article 20(3) of the Basic Law, Article 6(1) ECHR). The time limit begins with the official notification of the proceedings and ends with the legally binding conclusion of the proceedings.[8] According to the 'sentencing' solution,[9] an overly long duration of the proceedings due to improper conduct on the part of the public authorities is no longer taken into account as a mitigating factor during sentencing but is compensated instead through a reduction of the sentence to be imposed.[10]

The principles of the lawful judge and the right to be heard

are enshrined in the constitution and, on the one hand, prohibit the establishment of extraordinary courts and require that the judge, who will be called up to adjudicate the matter must be determined already at the outset to prevent any later manipulations, Article 101 of the Basic Law. The CCP and the Courts Constitution Act regulate the local, factual and functional jurisdiction of the criminal courts.[11]
In addition, the right to be heard (Article 103(1) of the Basic Law) obliges the court to hear the defendant, to permit him or her to submit applications and to consider such applications.[12]

The course of criminal proceedings

German criminal proceedings are divided into adjudication and enforcement proceedings. Adjudication proceedings are subdivided into the three stages of investigation, intermediate and main proceedings.

Investigation proceedings

are initiated either upon report of offence or *ex officio*, section 160(1) CCP. Pursuant to section 158(1) CCP, any one is entitled to report an offence with the public

8 Ruling of ECHR in: *Neue Juristische Wochenschrift(NJW)* 2006, 1645; judgment of the German Federal Court of Justice in: *Neue Zeitschrift für Strafrecht - Rechtsprechungs-Report (NStZ-RR)* 2001, p. 294.

9 Judgment of the German Federal Court of Justice in Criminal Matters (Grand Criminal Chamber), *BGHSt* 52, p. 124, at p. 166.

10 Judgment of the German Federal Court of Justice in: *Onlinezeitschrift für Höchstrichterliche Rechtsprechung zum Strafrecht (HRR-Strafrecht)* 2011 No. 255; W. Beulke § 2 para. 26.

11 W. Beulke § 2 para. 29.

12 Judgment of the German Federal Constitutional Court, BVerfGE 6, p. 19, at p. 20; 64, p. 135, at p. 144.

prosecution offence, police or the local court; no particular form is required for a report. General assumptions are not sufficient to launch investigation proceedings, at least a minimal level of suspicion is required. Accordingly, pursuant to section 152(2) CCP, there must sufficient factual indications that a potential criminal offence has been committed, i.e. there must be an initial suspicion. The actual investigation is carried out by the police, who are obliged to examine even independently any relevant act and transfer all findings to the public prosecution office. Certain police officers, acting as investigators of the public prosecution office, are entitled to impose coercive measures in urgent cases. At the same time, they are also subject to the investigative instructions of the public prosecution office, section 161 CCP.
The results of the investigation must ultimately show a probability that the criminal offence has been committed, i.e. a sufficient suspicion of the crime, section 170(1) CCP, to permit the public prosecution office to bring public charges before the competent criminal court. Otherwise, the public prosecution office must terminate the proceedings in accordance with section 170(2) CCP; they may, however, resume the proceedings at any time. In the case of certain offences open to private prosecution and in the event of a lack of public interest or if it is deemed opportune, the public prosecution office may also dispense with the prosecution.

The intermediate procedural stage

includes an initial examination of the indictment by the court as to whether or not main proceedings are to be commenced. The court will decide in this regard whether, in the light of the results of the public prosecution office's indictment and the objections raised by the accused, there appear to be sufficient grounds to suspect that the indicted accused has committed an offence, section 203 CCP. If this is the case, the court will open the main proceedings.

The main proceedings

includes the preparation and conduct of the main hearing against the defendant according to an established procedure, sections 243 et seqq. CCP. After the case has been called up, the defendant has been interrogated about their personal details, the reading of the indictment and interrogation on the substance of the case, the taking of evidence follows, which permits only four means of evidence, in addition to the defendant's statement, in questions of culpability and punishment: witnesses who can recount factual perceptions, experts who advise the court in matters in which the court lacks expertise, visual inspection, persons or objects that are sensually perceptible and documents, as documents with a conceptual content that can be read out.

Following the pleas on the part of the prosecution and the defence, the defendant is granted the last word before the court withdraws for deliberation and a decision is taken based on the court's free opinion gained from the hearing as a whole. The pronouncement of the verdict, acquittal or conviction, with an initial oral disclosing of the reasons for the judgment, concludes the main hearing.

Since 2009, the law permits the possibility of a 'plea bargaining deal' about the top and bottom limits of the sentence if the defendant confesses to the commission of the act.[13]

Within a period of one week, an appeal (section 314 CCP) or appeal on points of law only (section 341 CCP) can be lodged with the sentencing court to prevent enforcement, which means that the case will be referred to a higher instance. An appeal leads to a review of questions of fact and serves to clarify whether the determination of the facts and/or the application of the law by the lower court was erroneous. An appeal on points of law only, on the other hand, aims at a review of legal issues, although not every formal or substantive error of law may lead to the reversal of a judgment. The judgment can be challenged with the above legal remedies by the defendant and their defence lawyer as well as by the public prosecution office – also in favour of a convicted defendant. In principle, the legal consequences of the judgment may not be modified to the detriment of the defendant if the legal remedy is filed in favour of the defendant in order not to inhibit defendants from relying on the legal remedies for fear of incurring an even harsher sentence.[14]

If the legal remedies have become time-barred or are exhausted, the judgment becomes final and binding, and the adjudication proceedings are concluded. The final and binding judgment is irrevocable and a new conviction in the same matter is constitutionally prohibited, Article 103(3) of the Basic Law. Proceedings can only be reopened in the case of a manifestly unlawful conviction, section 359 et seqq. CCP.

A complaint (section 304 et seqq. CCP) can be filed as a legal remedy against decisions and orders of the court.

In simple cases, in which the facts have been clarified after completion of the investigation and it is a minor injustice, the public prosecution office can also apply for penal order proceedings in a court (sections 407-412 CCP). Penal order proceedings make it possible to reach a judgment without main proceedings and thus faster and more cost-effectively. However, if the accused objects to this, main proceedings shall be conducted.

13 C. Roxin, "StPO Einführung", p. XIII.

14 Ibidem, p. XIV.

Enforcement proceedings

The enforcement proceedings serve to implement the legal consequences imposed by a final and binding judgment. Pursuant to section 451 CCP the public prosecution office is again responsible in this regard. Prison sentences are executed through imprisonment in a correctional facility. If the convicted person refuses to pay their fine or fails to show up for a prison sentence, in the event that the convicted defendant is not under arrest, the public prosecution office will issue an arrest warrant to the police. Final and binding convictions are recorded in the Federal Central Criminal Register (*Bundeszentralregister*) managed by the Federal Public Prosecutor General (*Generalbundesanwalt*).

Jurisdiction of the criminal courts

Pursuant to section 1 CCP, the Courts Constitution Act determines which court and which adjudicating panel of that court shall have substantive jurisdiction in the first instance; this decision is essentially based on the extent of the expected punishment or the seriousness of the offence. The territorial jurisdiction of the court is decided in principle by the place where the crime has been committed but also according to the place of residence of the accused or the place of the accused's apprehension (section 7 et seqq. CCP).

The local court, as the lowest instance of ordinary jurisdiction, is in principle responsible for criminal proceedings in which no prison sentence of more than four years is to be expected, in the absence of any special reasons (section 24(1) of the Courts Constitution Act). In cases of a minor crime that does not carry a prison sentence of more than two years the criminal judge decides alone. For more severe offences or crimes carrying prison sentences of up to four years, a court with lay judges must be convened; this court must be composed of two honorary judges (lay judges) in addition to a professional judge.

The criminal divisions of the regional court are responsible in the first instance for criminal cases that are beyond the criminal jurisdiction of the local courts as a prison sentence of more than four years is to be expected. Pursuant to section 38(2) CCP, the maximum term of a fixed-term prison sentence is 15 years. In addition, it is possible to impose a life sentence for particularly serious crimes. If the criminal matter to be adjudicated is a capital crime (e.g. manslaughter, certain crimes that result in death), the criminal division is referred to as the criminal division with lay judges. The criminal divisions of the regional courts are composed of two or three professional judges and two lay judges. Being an appeal instance, the criminal division is responsible for appeals against judgments of the local courts.

The criminal senates of Higher Regional Courts are the highest criminal courts in the respective federal state (*Bundesland*) and are composed of three or five professional judges; no lay judges are involved at this level anymore. Inthe first instance, they are responsible for national security offences listed in section 120(1) of the Courts Constitution Act and cases that are likely to adversely affect the existence of the Federal Republic of Germany, which is also assumed in the case of right-wing extremist acts if the Federal Public Prosecutor General takes over the prosecution.[15] Most often, the Higher Regional Court acts as an appeal court, as it is competent for appeal against judgments of the regional courts or in cases of an immediate appeal on law only instead of an appeal on fact and law against judgments of the local court at first instance. This is also the final instance for criminal cases initially pending before the local court, meaning that they become final and binding – and thus enforceable – at this level.

The Federal Court of Justice (*Bundesgerichtshof, BGH*) in Karlsruhe, with its five final senates and as the highest judicial instance, decides solely on appeals on law only against first-instance judgments of the Higher Regional Courts in national security cases or first-instance judgments of the regional courts, which then become final and binding, since the legal recourse is exhausted in this case. If the conviction alleges a violation of fundamental rights, legal recourse to the Federal Constitutional Court is open.

Rights of the aggrieved and the accused parties in criminal proceedings

Due to the state's monopoly on criminal punishment, individuals are deprived of the right to pursue the punishment of an alleged offender themselves or to interfere with the offender's rights in order to investigate the crime. Only if a suspect is caught in the act, do citizens have a right to arrest in support of the prosecution. However, criminal charges can be filed orally or in writing at any time with the local courts, the public prosecution office and the police (here even online); the complainant receives a confirmation of this, section 158 CCP. If the offender is not proficient in the German language, the authorities must ensure communication.

As a person accused of a criminal offence, on the other hand, the individual as a subject of proceedings is endowed with considerable rights and can influence the course of the proceedings.

15 Judgment of the German Court of Justice in Criminal Matters, BGHSt 46, p. 238, at p. 250 et seq.

The aggrieved party of a criminal offence

In addition to the possibility of reporting a possible criminal offence when becoming aware of a possible criminal offence, a party immediately aggrieved by a criminal offence is also entitled to file an application for criminal prosecution within three months in the case of certain offences (absolute offences prosecuted on application), which concern rather the legal sphere of the aggrieved party than the general public and thus require the initiation of formal criminal proceedings, section 77 et seqq. CCP. In relative offences prosecuted on application, the public prosecution office can also prosecute without an application for the prosecution of the aggrieved person in the justified public interest.

The aggrieved party plays an active role in offences open to private prosecution and in private accessory prosecution proceedings.

Private prosecution (section 374-394 CCP) allows the aggrieved party, in the event of an offence open to private prosecution listed in section 374 CCP (e.g. bodily injury, defamation), to prosecute without the participation of the public prosecution office. In most cases, however, this is dependent on a failed conciliation attempt before a public conciliation board (usually a local conciliator, section 380 CCP). However, the public prosecution office is authorised to take over the prosecution proceedings again at any time, section 377 CCP.

Private accessory prosecution proceedings (sections 395-402) allow victims of certain criminal proceedings (listed in the catalogue of section 395) who have suffered severe injuries to their intimate legal rights as prosecutors in private accessory prosecution proceedings. An aggrieved party (close relatives in the case of killing offences) participates as an accessory prosecutor in the proceedings and is endowed with some rights. If the aggrieved party is adversely affected, they are even entitled to file legal remedies against the judgment. Private accessory prosecution proceedings is intended to provide victims with the opportunity to satisfy the desire for atonement due to the suffered injury to highly intimate personal rights.

In addition, the aggrieved party can use an application for joining the proceedings pursuant to 403 et seqq. CCP to claim compensation for their claims for damages under civil law already in the criminal proceedings (e.g. claims for compensation for pain and suffering) to avoid an additional civil action that would otherwise be required.

Other powers available to the aggrieved party are the right to apply for notification of the outcome of the proceedings, section 406 CCP, an inspection of the investigation file themself or by a lawyer, section 406e CCP and the right to avail themself of the assistance of an attorney or to be represented by such attorney, sections 406f, 406g CCP. In addition, according to section 172 CCP, the aggrieved party can lodge

a complaint with the public prosecution office when the proceedings are discontinued and file proceedings to compel public charges.
In addition to these active roles, the aggrieved party plays a passive role as a witness in criminal proceedings, sections 48 et seqq. CCP. As such, they are generally obliged to appear and to testify in the absence of any statutory right to refuse testimony. According to section 52(1) CCP, close relatives, such as fiancées, spouses, same-sex civil partners under the Civil Partnerships Act (*Lebenspartnerschaftsgesetz*) and relatives, are entitled to refuse to testify. However, this right does not extend to non-marital life partners or close friends. Certain persons under a professional obligation of secrecy and their professional assistants, sections 53, 53a CCP and civil servants and employees of the public service, whose employer refuses to grant authorisation to testify (section 54 CCP) are also entitled to refuse to testify. Witnesses may also refuse to answer any questions pursuant to section 55 and are not required to reply to individual questions, which would expose the witness or a close relative to the risk of being prosecuted for a criminal offence.
For the purpose of protection, witnesses can be examined by means of video (sections 68, 247a) or by a video recording of the statement (sections 255a, 58a CCP).

The party accused of a criminal offence

The accused is the party against whom the investigation is clearly directed, which presupposes at least an initial suspicion and the intention to prosecute on the part of the prosecuting authorities.[16] If the suspicion is directed at a person originally examined as a witness based on sufficient factual evidence, he or she will then become the accused and must be instructed of his or her rights in criminal proceedings. The accused's most important right is the right to remain silent on the alleged charges because they are not obliged to actively participate in the accusation. After all, he is not obliged to actively participate in proving their guilt. During interrogation, the accused must be informed pursuant to section 136(1) CCP about the offence with which they are charged and that they may avail themself at any stage of the proceedings of a defence counsel (defence counsel of the accused's choice, section 137 CCP); the appointment of a mandatory defence counsel is not generally required, only in the cases listed in section 140). The accused party must also be informed that they may request the taking of evidence for exoneration and may submit written submissions. An accused party is only obliged to appear if they have been summoned by the court or the public prosecution office, sections 133, 134 CCP. The police, too, is largely subject to the obligation to instruct the accused under sections 163a(4) CCP;

16 German Federal Court of Justice, Order dated 30/11/2014 – 2 StR 439/11.

however, a summons can only be enforced by the public prosecution office, section 163a(3) CCP. Incriminating submissions of the accused made to investigating officers without prior instruction will cause the statement to be inadmissible[17] unless the questions have been posed before outside an interrogation situation of a merely informational nature or were obtained with no possibility of prior instruction due to a spontaneous admission of the accused (spontaneous statement).[18] An absolute prohibition according to section 136a CCP applies to interrogation methods that impair the free will and the act of expressing the will of the accused, such as ill-treatment, fatigue, torture, administration of substances, deception or unlawful coercion. In addition, the accused is entitled to further rights. There is the right to inform consular representation in the case of an arrested accused of foreign nationality (section 114b II sentence 3 CCP in conjunction with Article 36(1)(b) of the Vienna Consular Convention), and the latter's right to be present (and consequently also compulsory attendance of the latter) at the main hearing, section 230(1) CCP. Furthermore, the submission of requests for evidence, section 244 CCP and the right to put questions to witnesses and experts, section 240 CCP. To the extent necessary for the preparation of the defence, an accused party, who has no defence lawyer, may claim the provision of information and copies from the investigation files in accordance with section 147(7) CCP, provided that this does not jeopardise the purpose of the investigation. Pursuant to section 147 CCP, only the defence counsel of the accused is entitled to inspect the file in full after the public prosecution office has noted the conclusion of the investigation in the file.

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IMPLEMENTATION OF MEANS OF EVIDENCE OBTAINED FROM PROCESS BODIES OF OTHER COUNTRIES

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International cooperation in the field of criminal proceedings, as pursued – due to the cross-border character of the crimes, the multidimensional *modus operandi* of the perpetrators, the geographical location as well as the professional, family, and financial relationships of people residing in the territories of the neighbouring States – has become an important tool for the execution of the aims and objectives of the criminal procedure. It is difficult to imagine that the possibilities of securing criminal evidence left in another state should not be used for combating continuously improved methods and activities of criminals operating in the territory of two or more states, where every systemic weakness is a pretext to embark on their shady dealings and keep on deriving benefit from committing crimes for as long as they possibly can. Therefore, close cooperation in the area of combating crime is of paramount importance for perpetrators' identification and prosecution. Creating a common ground for cooperation has great preventive and eliminating potential as well, since in the era of unlimited access to the Tor network[1] both the *modus operandi* and effective elimination of the criminal path are the subject matter of numerous publications and warnings in the dark web.[2] Collecting, securing and transferring evidence for another state's needs is thus rightly being perfected on a systematic basis by means of legislative initiatives of an international character.

International cooperation, originally based on the rules of the place of execution of an act, is still in effect in the European Convention on Mutual Assistance. A change introduced in the Convention on Mutual Assistance has enabled the execution of

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1 M. Krakowiak, T. Bajor, *Technika, Informatyka Inżynieria Bezpieczeństwa*, Częstochowa 2018, Vol. VI, pp. 575-590.

2 M. Majorek, *Bezpieczeństwo Teoria i Praktyka* 2017, Vol. 4.

requested acts within a formula of the requesting state's choice, on the assumption that any stipulated requirements are not inconsistent with the principles in force in the requested state. Based on permanent cooperation, as in the case of the project in question which assumes the risk of occurrence of a terrorist attack of a cross-border character, this rule is of great practical significance.

As an important element of reinforcing mutual trust and efficiency of the system of assistance in criminal matters, the fact should be noted of the renunciation of the rule of specialty in Directive 2014/41/EU,[3] providing the framework for the European Investigation Order, which, in practice, allows the use of an item of evidence also within other proceedings and concerning another person. This legislative measure is, therefore, seen as a continuing trend in the newest instruments of the European Union.[4] The procedure plays a key role in case of terrorism-related and cross-border crimes in which the scope of causative actions and preparation for a crime itself, followed by forms of removing its traces, may be so complex that the inability to implement evidence obtained in an initial phase of the procedure into other uncovered events after the stage of execution of legal assistance, might considerably hinder proper proceedings and, as a result, have an adverse effect of law enforcement agencies' effectiveness.

International cooperation in the scope of the criminal procedure

Any assessment of legal options for establishing cooperation in the scope of obtaining evidence for the purposes of the criminal procedure should be preceded by an analysis of agreements that bind the Republic of Poland with a given state. As regards member states of the European Union, the applicable law is Directive of the European Parliament and of the Council No 2014/41/EU of 3 April 2014 regarding the European Investigation Order in criminal matters. Another essential legal instrument providing the basis for mutual cooperation are multilateral international agreements, and among these, the most important one, binding with respect to states that have not introduced the EIO, is the European Convention on Mutual Assistance in Criminal Matters of 20 April 1959 concluded in Strasbourg, together with the Second Additional Protocol drawn up on 8 November 2001.[5] In case of countries that are not parties to the directive or convention, bilateral or multilateral agreements apply. The last legal assistance formula is an application on the basis of the provisions of national law as stipulated in Art. 585 CCP (the Code of Criminal Procedure).

3 Directive of the European Parliament and of the Council of 03.04.2014 (No 2014/41/EU).

4 M. Kusak, *Dowody zagraniczne. Gromadzenie i dopuszczalność w polskim procesie karnym*, Warszawa 2018.

5 Journal of Laws of 1999 No 76, Item 854.

The authority to issue a European Investigation Order (hereinafter: EIO) in the course of the preparatory proceedings is the prosecutor in charge of the prosecution process, the Police and other bodies conducting the preparatory proceedings, including revenue offices and revenue and customs offices. In case of an EIO being issued by a body other than a prosecutor, the prosecutor's approval is required for the EIO to be effective. An EIO may be issued for the purpose of performing any evidentiary action, both *ex officio* or at the request of a party, the defence lawyer or the attorney. The basic substantive criterion is its necessity and proportionality for the purposes of the proceedings in progress. The European Investigation Order is reserved for a sole decision of the Court in the following matters:

- surveillance and recording of the content of telephone conversations and recording by technical means of the content of other conversations or information transmissions, including correspondence sent by electronic means,
- temporary transfer of a person deprived of liberty,
- hearing in the capacity of a witness of a minor under the age of 15 in cases of offences committed by use of violence or unlawful threat or ones specified in Chapters: XXIII (Offences against Liberty), XXV (Offences against Sexual Liberty and Decency) and XXVI (Offences against the Family and Guardianship) of the Criminal Code,[6] when the witness's testimony may be relevant for the determination of a case and only once in the course of the entire proceedings (again on an exceptional basis, if important circumstances have come to light or as requested by the accused who did not have a defence lawyer during the first hearing of the aggrieved party),
- hearing of witnesses on circumstances comprising a professional or official secret,
- accessing information protected by bank secrecy.

Legal basis of implementation of means of evidence into the Polish criminal procedure

In Chapter 62 of the Code of Criminal Procedure,[7] in Article 587, the legislators defined the framework and principles of the admissibility of evidence as secured, recorded or produced in the territory of another state. This provision directly allows the possibility of using items of evidence drawn up by courts, foreign countries' prosecutors or bodies acting under their supervision directly at a trial in the Polish criminal procedure. Such items of evidence may be implemented within one of the forms of international cooperation provided by the act, as activated by a Polish prosecutor

6 The Act of 6 June 1997, the Penal Code, Journal of Laws of 2018, Item 1600, as amended.

7 The Act of 6 June 1997, the Code of Criminal Procedure (consolidated text: Journal of Laws of 2018, Item 1987, as amended).

or court, i.e. within the cooperation of European Union authorities (Art. 589g CCP – Art. 589zt CCP), in connection with the transfer of prosecution (Art. 590 CCP), within a Polish investigation team (Art. 589c CCP), as well as within legal assistance. It is also possible to introduce into the Polish procedure evidence produced by another state which conducts its own proceedings.

Formal conditions for the implementation of evidence

The prosecutor or court's essential act following the obtainment of an item of evidence from another state is the necessity to perform the rule of law test which, in practice, consists in evaluating a specific procedural act in the context of the principles of the Polish legal order, as generally binding and applicable at the moment of the proceeding.

In the first place, a specific act must be evaluated with respect to constitutional principles and principles contained in ratified international agreements, in particular, the most important is the evaluation of the principle, as expressed in Art. 45 of the Constitution, of the right to a fair trial and the principle of the right to defence.[8] Thus, the scope of the evaluation comprises guarantees and rules of general nature as well as the basic principles of the criminal procedure[9,10]. In a situation when an individual's rights and basic principles of the legal order are characterized by considerable deviation from the values of the Polish legal order, then such evidence must not be used in the criminal procedure. Higher standards entitle positive evaluation of evidence.[11]

The positive evaluation of the principles of fundamental nature provides a basis for the next stage being connected with a more detailed analysis, since it concerns *stricte* evaluation of evidence, which is given priority even over the principle of material truth by the legislators. It is about evaluating a particular item of evidence from the point of view of norms prohibiting the obtainment and utilization of a specific item of evidence in the procedure. These norms are defined in the literature and inadmissibility of evidence. In fact, the classification, as proposed, orders legal norms specified in the Code of Criminal Procedure depending on the weight and kind of violations of the same. Prior to the discussion of inadmissibility of evidence, it should be noted that in the Polish criminal procedure the notion of evidence is of an open character. It is a notion that appears in many aspects, including during the

8 These principles constitute also a key element of the European Convention for the Protection of Human Rights and Fundamental Freedoms (Art. 6).

9 Judgment of the Court of Appeal In Kraków of 30 November 2004, II AKa 234/04, LEX No 149776.

10 L. Paprzycki (ed.), *Komentarz aktualizowany do art. 425-673 kodeksu postępowania karnego*, lex/el, 2014.

11 S. Steinborn, in: J. Grajewski, L.K. Paprzycki, S. Steinborn (eds.), *Kodeks postępowania karnego*, Vol. II, 2015; L. Gardocki, in: R.A. Stefański, S. Zabłocki, *Kodeks postępowania karnego*, Vol. III, 2004.

formulation of the principles of the criminal procedure.[12] A source of evidence may be both a person and an object, however the means serving to obtain and record a specific item of evidence has a defined formula and, depending on the degree of a breach, may disqualify the evidence from the proceeding. Evidence is also subject to disqualification that pertains to circumstances or facts as strictly defined in the act. A consequence of the open catalogue of the notion of evidence is that in the Polish criminal procedure there are no limitations as to the means that may become evidence. Everything that serves to establish circumstances of importance for the determination of a case and that is not covered by the principle of inadmissibility of evidence may be used as proof and will be evaluated as any other means of evidence.[13] Inadmissibility of evidence may pertain to any of the three essential designates of the notion of evidence, i.e. source of evidence, means of evidence or evidence thesis.[14] Despite the existence of a number of concepts regarding the classification of inadmissibility of evidence,[15] as regards the decisive criterion of its classification,[16] the clearest and useful in everyday practice seems to be the one proposed by K. Marszał,[17] who divides it into inadmissibility of demonstrating evidence, inadmissibility of using evidence and inadmissibility and unacceptability of evidence. Inadmissibility of demonstrating evidence has been divided into two further groups, i.e. inadmissibility of demonstrating a definite evidence thesis and inadmissibility of demonstrating a specific item of evidence. Inadmissibility of demonstrating a definite evidence the SIS pertains to the course of deliberation and voting on the decision (Art. 108 CCP), inadmissibility of demonstrating a right or legal relationship against a final and formative judgement of another court (Art. 9 CCP) as well as inadmissibility of demonstrating the accused person's statement as to the act with which he/she has been charged, if the same has been made before a physician providing medical assistance or in the presence of an expert witness (Art. 199 CCP). Inadmissibility of demonstrating a specific item of evidence has been divided into absolute and relative.

12 K. Witkowska, "Dowody w procesie karnym a realizacja celów postępowania karnego", *Przegląd Sądowy*, March 2011, *passim.*

13 P. Hofmański (ed.), E. Sadzik, K. Zgryzek, *Kodeks postępowania karnego, Tom I, komentarz do art. 1-296*, Warszawa 2007; T. Grzegorczyk, J. Tylman, *Polskie postępowanie karne*, Warszawa, 2007; S. Waltoś, P. Hofmański, *Proces karny. Zarys systemu*, Warszawa 2018; Judgement of the Appellate Court in Szczecin of 20 November 2019, II AKa 197/19, lex No 3208018.

14 M. Rusinek, *Z problematyki zakazów dowodowych w postępowaniu karnym*, Warszawa 2019.

15 S. Śliwiński, *Polski proces karny przed sądem powszechnym*, Warszawa, 1961; M. Cieślak, *Zagadnienia dowodowe w procesie karnym*, Vol. I, Warszawa 1955; W. Daszkiewicz, *Proces karny*, Vol. I, Toruń 1985; T. Grzegorczyk, in: T. Grzegorczyk, J. Tylman, *Polskie postępowanie karne*, Warszawa 2014; T. Grzegorczyk, *Kodeks postępowania karnego*, Kraków, 2004; M. Lipczyńska, *Polski proces karny*, Warszawa–Wrocław 1973; S. Waltoś, P. Hofmański, *Proces karny*, Warszawa 2021; C. Kulesza, in: B. Bieńkowska, P. Kruszyński, C. Kulesza, P. Piszczek, *Wykład prawa karnego procesowego*, Białystok 1998.

16 Z. Kwiatkowski, *Zakazy dowodowe w procesie*, Kraków 2005.

17 K. Marszał, *Proces karny*, Katowice 1998.

Absolute inadmissibility of evidence is permanent in character, so the legislators have not provided for any conditions whose fulfilment could restore the effectiveness of such evidence. This inadmissibility in the Polish criminal procedure includes, as follows:

a) inadmissibility of hearing the defence lawyer as a witness as to facts of which he/she has learned while providing legal advice or pursuing his/her case (Art. 178 Point 1 CCP);
b) inadmissibility of hearing a clergyperson as to the facts of which he/she has learned in confession (Art. 178 Point 2 CCP);
c) inadmissibility of reading out the record of a hearing of a witness if this person has afterwards been heard in the capacity of the accused (Art. 182 CCP, Art. 391 § 2 CCP).

Relative inadmissibility of evidence pertains to such situations that, having fulfilled an additional criterion – most often obtainment of a secrecy waiver – may constitute evidence in the proceedings. Absolute inadmissibility of evidence in the Polish criminal procedure includes, as follows:

– inadmissibility regarding state secrecy (Art. 179 CCP),
– inadmissibility due to official secrecy (Art. 180 CCP),
– inadmissibility due to professional secrecy (Art. 180 CCP),
– inadmissibility regarding the *right to refuse to testify* (Art. 182 CCP),
– inadmissibility regarding a person being in a particularly *close relationship* with the accused (Art. 185 CCP),
– inadmissibility of hearing witnesses who enjoy diplomatic immunity (Art. 581 CCP, Art. 582 § 1 CCP).

In the Polish legal system, there are also other instances of inadmissibility that pertain to evidence obtainment methods, i.e. inadmissibility of using statements made under duress, statements made under hypnosis or as a result of the operation of chemicals affecting the mental processes or aiming to control unconscious reactions of the organism (Art. 171 CCP). In addition, there is as well inadmissibility of using statements made under conditions precluding freedom of expression (Art. 171 § 7 CCP).

The catalogue of the instances of inadmissibility of evidence is complemented by the inadmissibility, as expressed in Art. 168a CCP, of using evidence obtained in connection with a public official's performance of his/her official duties as a result of homicide, intentional causing of detriment to health or deprivation of liberty.

Making use of the abovementioned concept of classification of inadmissibility of evidence, depending on the weight of violations, despite having obtained a specific item of evidence by way of legal assistance from another state, any evidence that is subject

to absolute inadmissibility must not be subjected to implementation into the Polish procedure.

The last stage of the procedure is connected with such elements as the method of recording actsand the time and conditions of conducting acts. It is assumed that the way of securing or obtaining evidence by the requested party need not be identical to the procedure and conditions of Polish criminal proceedings[18] (the review ought not to have a formalistic character[19]). In practical terms, an important problem in relations with German partners may result from the inadmissibility as defined in Art. 174 CCP, which proscribes substitution of evidence of the accused person's statement or witnesses' statements with the contents of letters, records or official memos, as well as the inadmissibility provided in Art. 143 CCP which pertains to the obligatory form of recording such secured evidence as acceptance of reports of a crime, complaints for prosecution, interrogation of a suspect, the accused, a witness, external examination and opening of the body, conducting an experiment, cross-examination, identity parade, making a search, impounding objects and other information technology data, opening of correspondence and parcels, replaying recorded conversations, familiarization with files, acceptance of a bail, recording of the course of a court sitting. In this context, due to the inadmissibility as referred to in Art. 393 § 1 CCP, the possibility may raise doubts of reading out a note drawn up by the body executing a request for legal assistance with respect to such evidence as to which the Polish procedure provides for the obligatory form of a record. In practice, Polish jurisdiction is quite liberal and allows even reading out records that have not been signed by an oversight of the party to have executed mutual legal assistance.[20]

The level of trust as to a given state's legislative conformity, which, in practice, determines the scope and workload needed to evaluate the criteria under Art. 587 CCP enabling the implementation of a given item of evidence, depends on current relations and obligations that have been assumed by the state executing a specific request for mutual legal assistance. In general, the systematics and engagement in the process of mutual recognition of common values are the closest among the members of the European Union. This is so because these states recognized, by virtue of the Treaty on European Union, the fundamental principles as defined in the Charter of Fundamental Rights of the European Union of 7 December 2000, in the wording of 12 December 2007[21], and, additionally, implemented common procedural norms and guarantees which refer directly to the rules of recording evidence. i.e. Directive (EU) 2016/343 of the European Parliament and of the Council of 9 March 2016

18 Decision of the Supreme Court of 28 March 2002, VKKN 122/00, lex 53740.

19 D. Świecki (ed.), *Kodeks postępowania karnego*, Vol. II, Warszawa 2018.

20 Judgement of the Appellate Court in Cracow of 11 May 2009, II AKa 169/08, lex No 533944.

21 Official Journal of the European Union 2016/C 202, /01, 7 June 2016.

on the strengthening of certain aspects of the presumption of innocence and of the right to be present at the trial in criminal proceedings, Directive 2013/48/EU of the European Parliament and of the Council of 22 October 2013 on the right of access to a lawyer in criminal proceedings and in European arrest warrant proceedings, and on the right to have a third party informed upon deprivation of liberty and to communicate with third persons and with consular authorities while deprived of liberty, Directive 2010/64/EU of the European Parliament and of the Council of 20 October 2010 on the right to interpretation and translation in criminal proceedings, as well as Directive 2012/13/EU of the European Parliament and of the Council of 22 May 2012 on the right to information in criminal proceedings. The adoption of the above rules and obligations results in the level of trust in the legal order of the state executing a request being much higher, which may significantly simplify the evaluation of the legal order conformity, as referred to in Art. 587 CCP.

Bearing in mind the practical aspect of this study, it should be indicated that in the theory of the legal system of Germany there is a classification of inadmissibility of evidence as well.[22] This system distinguishes two main groups, that is inadmissibility regarding evidence taking and inadmissibility regarding evidence use. The evidence taking inadmissibility has been broken up into three further subgroups, i.e. inadmissibility of evidence thesis, which is related to inadmissibility of demonstrating specific facts, e.g. judicial deliberation, inadmissibility of sources of evidence that relate to a selected group of means of evidence, e.g. inadmissibility of hearing a witness who has refused to testify, as well as inadmissibility of evidence methods, e.g. regarding the application of means excluding an interrogated person's will. In the German procedure there occurs also the so-called relative inadmissibility that pertains to obtaining evidence in relation to persons as specified in the act. German law provides for inadmissibility of such means that do not follow from statutory provisions, but result from the theory to have been elaborated in the doctrine.[23]

Principles of introducing evidence into the procedure

Evidence obtained at the request of a Polish court or prosecutor, following its/his/her evaluation from the point of view of the prerequisites pursuant to Art. 587 CCP, and, subsequently, having been translated by an expert witness into the official language, may be read out at the main trial in line with the rules as specified in Art. 389 CCP, Art. 391 CCP, Art. 393 CCP. The introduction of evidence into the procedure occurs, in practice, as soon as at the stage of preparatory proceedings, however such evidence, like any other, is reverified also from the point of view of the prerequisites

22 Z. Kwiatkowski, *Zakazy dowodowe w procesie karnym*, Kraków 2005.

23 Ibidem, loc.cit.

as referred to in Art. 587 CCP in the course of the trial by the Court. In this manner, it is possible to disclose not only the records of acts that require being recorded, but also evidence produced autonomously by a body of another state, and materials originating from operational and investigative activities,[24] accounts and reports produced by other countries' authorized bodies[25] This procedure also allows disclosure of audio recordings which, by their very nature, cannot be read out,[26] as well as the written records of these conversations to have been played.

Irrespective of the national conditions providing the basis for disclosing evidence by reading it out at the trial, the standards developed in judicial decisions of the European Court of Human Rights[27] introduce additional reflection into this type of evidence on the procedural guarantee of the accused person's right to defend himself/herself. In the ECHR's opinion, conviction must not be based exclusively on testimonies that the defence could not have questioned in the course of the proceedings, thus being unable to actively confront, at any stage whatsoever of the criminal procedure, the contents of such a witness's claims. It need be noted, however, that, as a general rule, the ECHR allows a possibility to confine oneself to disclosing the contents of a witness's statements, whose testimony is not the only incriminating evidence to constitute a later decision in the case.

Issues of implementation of own evidence produced by a foreign country

In practice, such situations may occur in which the execution of the principle of material truth necessitates the use of evidentiary material from proceedings conducted by a foreign country (most frequently these are situations concerning activities of the same criminal groups or crimes of a cross-border character). While it is true that Art. 587 CCP does not provide, *expressis verbis*, for using evidence obtained for the purposes of a foreign country's proceedings in the form of disclosing the same at a trial, still the hitherto developed case law[28,29,30,31] provides for a possibility to make use of such material in the course of the proceedings, by reading out a specific record pursuant to Art. 391 CCP.[32]

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24 Judgement of the Appellate Court in Białystokof4 December 2013, II AKa 218/13, lex 1416380.
25 S. Hoc, *Komentarz praktyczny*, lex el/2016.
26 Judgement of the Appellate Court in Cracow of 16 May 2017, II AKa 45/17, lex No 2519007.
27 Judgement of the ECHR of 10 May 2011, 17354/04.
28 Decision of the Supreme Court of 28 March 2002, VKKN 122/00, lex 53740.
29 Judgement of the Appellate Court in Cracow of 3 October 2002, II AKa 215/02.
30 Judgement of the Appellate Court in Cracow of 14 December 2010, II AKa 191/10, lex No 852398.
31 Judgement of the Appellate Court in Lublin of 21 July 2010, II AKa 165/10, lex No 628240.
32 K. Dudka (ed.), *Kodeks postępowania karnego. Komentarz*, Vol. II, Warszawa 2020.

Cooperation with the Federal Republic of Germany – examples of using the EIO in the criminal procedure[33]

Example No 1
The District Public Prosecutor's Office in Gryfino was conducting a vehicular homicide proceeding. A German citizen is a suspect. In the course of the proceedings, it was established that the suspect had been treated for a psychiatric disorder in Germany in the past. The District Public Prosecutor in Gryfino issued a European Investigation Order requesting that the suspect be subjected to an examination by two psychiatrists, providing the content of questions to the experts as consistent with the content of the rules of the Polish criminal procedure. The European Investigation Order was accepted for execution by the German party.

Example No 2
The Regional Public Prosecutor's Office in Szczecin conducts a homicide proceeding, the victim being a female Polish citizen, the suspect being a man, also a Polish citizen. The homicide took place in Germany. The German prosecutor's office instituted separate proceedings in this case. The Regional Public Prosecutor in Szczecin issued a number of European Investigation Order, among others requesting an inspection and opening of the dead body. The German Party acceded to the application and the procedural acts were executed. Having obtained a report of the external examination and opening of the body, the documents were translated into the Polish language and included in the evidentiary material contained in the case file.

Example No 3
The District Public Prosecutor's Office in Gryfice conducts a marine accident proceeding, which resulted in the death of four fishermen. In June 2019, In Germany, a corpse was recovered of a man with respect to whom suspicion was raised that it was one the Poles who had died in the accident. The District Public Prosecutor in Gryfice issued an EIO requesting, among others, that the dead body was released in order to have it inspected and opened. The German party accepted the Order for execution, however, they requested that the genetic profile of the deceased Pole's family members be sent in order that the body was identified, after which the same was to be released. The Regional Public Prosecutor in Szczecin sent to the German party the DNA profile of the brother of the deceased, his toothbrush and a photo of the characteristic tattoo on his chest. Following the establishment of the identity of the corpse and confirmation that it was one of the deceased fishermen, relevant information was sent to the Polish party, and then the German prosecutor gave his

33 Cases of criminal proceedings conducted in the District Prosecutor's Office in Szczecin and in subordinate prosecutor's offices.

consent to the cremation of the body which was executed by a competent agency, thus rendering it impossible to execute the European Investigation Order within the scope of the release of the body.

Conclusion

The existing legal regulations and practice, as developed by way of the long-term co-operation, provide the possibility of implementing evidence effectively in the criminal procedure, without detriment to the parties' procedural guarantees. Evidentiary material originating in foreign countries may, in principle, be used in the Polish criminal procedure. The basic condition for admissibility of an item of evidence taken abroad is the recognition that its taking is not inconsistent with the legal order of the Republic of Poland (Art. 587 CCP). Information obtained from evidence taken by process bodies of another state, either within own proceedings or on Polish enforcement authorities' initiative by way of legal assistance, unless it has not been obtained in a way as inconsistent with the legal order of the Republic of Poland, may constitute a basis of findings as being established in the course of criminal proceedings in progress. Such evidence is assessed as any other item of evidence taken in Poland and has the same value and effect in the process of proving and judging. Differences between the legal systems of Poland and Germany, in the light of the national judicial decisions, do not cause problems as far as ongoing evidence collection and transfer by the requested state. In case grave threats should occur in relation to a terrorist attack of a cross-border character, process bodies in Poland may effectively secure and transfer evidence to another state, as well as request and obtain this type of evidence for the purposes of their own proceedings.

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LEGAL CONDITIONS OF TRANSPORTING EVIDENTIAL AND REFERENCE MATERIAL AMONG COUNTRIES IN THE LIGHT OF REGULATIONS IN FORCE IN THE TERRITORY OF POLAND

MATEUSZ TOMCZYK*

On the ground of cooperation of Polish and German law enforcement agencies, an essential issue is a procedure of exchanging evidential materials secured at incident scenes (in particular biological traces), as well as reference materials being obtained. As it turns out, however, the issues of recovering, securing, and transporting these materials may differ in respective legal systems. These differences of a procedural and technical nature may result in a situation when an evidential or reference material, as sent, will not qualify for further analysis and examination in one of the parties' opinion. Therefore, the purpose of this paper is to offer an insight into the regulations defining the rules for securing and transporting evidential and reference materials that are in force in the territory of the Republic of Poland.

Within the framework of Polish-German cooperation, it is a crucial issue to improve the procedure of exchanging evidential materials and reference materials in preparatory proceedings conducted in parallel. A condition to enable swift and effective use of these materials is the need to secure the same in an appropriate way, as well as to transport it across the border (within both the formal and technical meanings). On this ground, however, discrepancies may occur between the Polish and German legislations. These discrepancies may even lead to a danger that one party may not recognize an evidential or reference material for *stricte* formal or technical reasons, like, for instance, due to unsuitable packaging, improper carriage of the material, or because the record or label is missing, as appropriate. Then, one party may not recognize the materials sent as useable for taking the evidence *sensu largo*.

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In view of the above, within the framework of this study, the question of Polish legal conditions of transporting evidential and reference material abroad (ultimately to the Federal Republic of Germany) will be presented.

It must, however, be emphasized that international legal acts and laws included in the *acquis communautaire*, as well as acts of national law of the standing of primary legislation, do not provide us with an unequivocal answer in what way, specifically – both informal and technical terms – should cross-border, between Poland and Germany, carriage of evidential materials and reference materials take place. Obviously, there are legal acts that outline fundamental rules relating to the manner in which this cooperation should take place on a procedural (but not formal and technical) level. An important institution is, for example, the European Investigation Order (hereinafter: EIO), established for the purposes of cooperation between the Member States of the European Union. It is defined as "a judicial decision which has been issued or validated by a judicial authority of a Member State ('the issuing State') to have one or several specific investigative measure(s) carried out in another Member State ('the executing State') to obtain evidence."[1] The essence of this measure for Community law enforcement and judicial cooperation is to ensure that evidence is properly obtained, and not just to focus on the evidence itself and its transfer to the issuing State.[2] In other words, as indicated in the literature, in relation to the EIO institution, it concerns creating conditions that facilitate the recognition of evidence obtained in another Member State (the EIO gives the admissibility of evidence indirectly).[3] The State carrying out the "proceedings to take evidence" should act as specified in the EIO request by the issuing State. The executing State should therefore endeavor to carry out the proceedings to take evidence in accordance with the conditions outlined in the EIO and cannot, or at least should not, use its own methods.[4] This means that we are dealing with the next stage of international cooperation. The issue of how to obtain evidence is an element that distinguishes the EIO from a traditional application – which of course does not mean that we have such a significant change in international cooperation in this field.[5] Earlier, the obligation of the requested state to ensure that it meets the formal and procedural requirements clearly defined

1 Directive 2014/41/EU of the European Parliament and of the Council of 3 April 2014 regarding the European Investigation Order in criminal matters, Official Journal of the European Union of 2014, L 130/1.

2 K. Grzegorz, *Europejski nakaz dochodzeniowy*, "Prokuratura i Prawo" 2015, No 12, p. 76.

3 S. Ruggeri, "Introduction to the Proposal of a European Investigation Order: Due Process Concerns and Open Issues", in: S. Ruggeri (ed.), *Transnational Evidence and Multicultural Inquiries in Europe. Developments in EU Legislation and New Challenges for Human Rights-Oriented Criminal Investigations in Cross-border Cases*, London 2013, p. 10.

4 K. Grzegorz, *Europejski nakaz dochodzeniowy*…, p. 76.

5 A. Farries, *The European Investigation Order: Stepping Forward with Care*, "New Journal of European Criminal Law" 2010, No 4, p. 432.

by the requesting state was already present and expressed under the *forum regitactum* principle. The basis for the refusal by the State carrying out the proceedings to take evidence to proceed in a predetermined manner was the fact that the indicated formality or procedure was to be contrary to the fundamental principles of the law of that State.[6] However, it should be remembered that the Community provisions governing the EIO institution do not impose on the Member State the conditions and criteria for the admissibility of using evidence obtained abroad and making true findings of fact based on it. This question is ultimately the responsibility of the national jurisdiction of the Member State concerned.

The EIO has been implemented into the Polish legal system as an element of the codified criminal procedure. Therefore, according to Art. 589w § 1 CCP, in case of a need to take or obtain evidence that is located or may be taken in the territory of another Member State of the European Union, the court before which the case is pending, or the public prosecutor who is conducting the preparatory proceedings, may issue, *ex officio* or on the application of a party, defence lawyer or attorney, an EIO decision, unless the EIO is not applicable in this state.[7] It is worth noting that an EIO, pursuant to Art. 589w § 3 CCP, may also be issued in order to preserve traces and evidence of a crime against being lost, deformed, or destroyed. Hence, the rule provides an opportunity to apply, under the EIO procedure, for securing biological traces and other ones which, as an evidential or reference material, may be used for the purposes of Polish criminal proceedings. On the ground of the EIO, the national legislator has, however, provided freedom of choice to Polish law enforcement agencies, namely, it is left to the discretion of a law enforcement agency to point out to the law enforcement agency of a Member State to which it applies whether to transfer the traces or evidence or leave the same in the state of execution of the decision, that is the state to which the EIO is addressed. In case the trace or evidence is to remain in the state of execution of the decision, the authority to have issued the EIO specifies the time limit for the securing to be in effect. Such a provision is found in Art. 589y § 3 CCP. National regulations also define a situation when another Member State may apply to Polish law enforcement agencies for the execution of an EIO in Poland. Therefore, pursuant to Art. 589ze § 1 CCP, in the event of an application by a Member State of the European Union for the execution of an EIO, an order to this effect is issued by a Polish public prosecutor or the district court in whose jurisdiction the evidence is located or may be taken. In case, however, a Member State moves to Polish law enforcement agencies for an EIO, then the applicant state may also move for the

6 Convention of 29 May 2000 on Mutual Assistance in Criminal Matters between the EU countries, Official Journal of the European Union of 2000, L 197/1.

7 Chapter 62c and 62d of the Act of 6 June 1997 – the Code of Criminal Procedure (Journal of Laws 1997, No 89, item 555, as amended).

application of the local regulations regarding the method of obtaining, recovering, and securing traces or items of evidence. Of course, the Polish side is obligated to do it according to the procedures of the applicant state's specification, with the proviso, however, that these procedures must not be inconsistent with our legal framework (to be understood broadly, as fundamental constitutional values or the rules of the criminal procedure). In line with Art. 589zi § 1 CCP, unless the regulations of Chapter 62c CCP have it otherwise, provisions of Polish law apply to the execution of an EIO. Still, the EIO-issuing authority's request must be satisfied so that a specific procedure or a specific form should be applied while proceedings if it is not contrary to the principles of the legal order of the Republic of Poland.

Another form of introducing into the Polish process of evidence obtained outside the country, may be the procedure as defined fundamentally in Art. 587 CCP, according to which reports, as made upon an application of a Polish court or prosecutor, of visual inspections, suspect, witness and expert interrogations/questioning, or records of other evidentiary actions, as performed by foreign state's courts or prosecutors, or authorities acting under their supervision, may be read out at a trial on the principles laid down in Art. 389 CCP, Art. 391 CCP and Art. 393 CCP, if the method of performing the action is not inconsistent with the principles of the legal regime of the Republic of Poland.

A worth noting form of cooperation of law enforcement agencies are Joint Investigation Teams.[8] Within such a Team, members act in accordance with the law of the State in which the proceedings are conducted. A wider scope of this institution is found at the statutory level within the framework of national law. That is why evidential and reference materials remain, as a rule, in the territory of the state wherein such a Team operates.

Yet, the above-mentioned, and discussed in brief, institutions of procedural cooperation do not specify in detail how evidential material and reference material should be transferred between law enforcement agencies of various Member States (on the formal and technical planes). Therefore, these issues lie within the range of authority of regulations to be found at the level of delegated legislation, secondary to acts of international and statutory law. Only the record-keeping of trace recovery and preservation procedures is regulated strictly at the statutory level, it is in the CCP. However, the instructions as to the method in which an evidential material and reference material should be transferred between law enforcement agencies of various Member States, are to be found in the contents of internally binding acts, not generally applicable ones.

8 Convention of 29 May 2000 on Mutual Assistance in Criminal Matters between the EU countries, Official Journal of the European Union of 2000, L 197/1.

In view of the above, when referring to our domestic legal system, it is necessary to refer to internally binding guidelines, appropriate for the entire structure of the uniformed police service. And so, at the level of internally binding regulations, when materials are transported from the police facility to the laboratory, a parcel with forensic material should have packaging ensuring the protection of its contents against replacement, damage, or destruction, as well as appropriate identification labelling. Moreover, if it is known that forensic material may pose a threat to life or health, information about this fact should be placed visibly on the packaging. The parcel containing the forensic material that has been prepared or delivered in a manner inconsistent with separate regulations, in particular, those applicable to the performance of procedural activities, protection of classified information, as well as methods and forms of office work in the Police, should be returned immediately to the sender.[9] This procedure, by analogy, can also be used to transport materials from a Polish police facility to a German police facility.

Moreover, the documentation relating to an order for a parcel containing such material should be sent in a separate envelope with the inscription "Documentation" (appended to the packed forensic material – since the point is that the documentation for the parcel order can be accessed without interference with the forensic material packaging). And here also, in the event that a parcel has not been packaged in an appropriate way, the relevant laboratory employee is obligated to contact the ordering party immediately and obtain the documentation of the order. If it is not possible to obtain the documentation of the order, the parcel must be returned to the ordering party.

It must be remembered that during transport, the evidence should be secured in such a way as to ensure the most effective protection against:

- destruction or alteration of identifying characteristics, in particular by removal of traces;
- introduction of random materials, in particular traces left by persons participating in the visual inspection, as well as transferring material from another place or thing;
- contact with another evidential material, including allowing direct contact (e.g., contact of secured clothes of the injured party and the suspected person by storing clothes together, without protection) or indirect one (e.g., by questioning

9 Regulation No 10 of the Police Commander in Chief of 7 May 2015 on the manner of handling forensic materials and the procedure for creating and maintaining forensic collections in the Police forensic laboratories.

several persons at the same time in the same room or transporting them on the same vehicle prior to securing their clothes).[10]

The above is just an outline of the formal side of the procedure of packaging forensic material. In the remaining respects, on the other hand, that is regarding the technical aspects of packaging this material and regarding the method of transferring the same, one should rely on the experience and forensic knowledge of the police officer who initiates such a parcel. Here we can deal with various categories of biological traces, such as blood, skin, hair, nails, bones, soft tissue fragments, muscles, bodily secretions, and excretions, which may be found on different carriers. These biological traces undoubtedly provide valuable evidential material from the incident scene. Besides, we have reference material, collected from the preselected person under Art. 192a CCP, or the suspected person or the suspect himself/herself under Art. 74 § 2 and § 3 CCP. Still, from the point of view of the Polish criminal procedure and other legal regulations, as thematically close thereto, there is no detailed guidance as to the very method of packaging and transporting materials. In case of bringing evidential and reference materials to Poland, these may constitute evidence, once properly secured, according to forensic knowledge, in a way as preventing decontamination or degradation of the same.

Thus, bearing in mind the above, two answers should be given concerning the matter:

1. What formal requirements do we have to meet so that the material sent by us can be considered "legal"?
2. What formal requirements does the sender have to meet so that we can consider the material sent to us "legal"?

As regards the first question, the situation can follow a two-way course. In the first one, a state applying to Poland – within the EIO for instance – wishes that we obtain, e.g., a reference material according to their procedure and guidelines. In this case, we should satisfy such a request, having verified, however, whether the requesting state's guidelines are not contrary to our legal framework and principal elements of the Polish criminal procedure. In the event of the second situation, an applicant state does not make a request regarding a method of securing and transferring evidential or reference materials. Then we use domestic regulations to this effect, and simply send the forensic material, as properly secured. In this respect, at the stage of recovering and securing evidential material (biological traces from the incident scene), it is therefore necessary to draw up a visual inspection report pursuant to Art. 143 § 1 Point 3 CCP, and in accordance with the internally binding guidelines within

10 Guidelines No 3 of the Police Commander in Chief of 30 August 2017 on the performance of certain investigative activities by police officers.

the structure of the Polish Police.[11] The evidential material is recovered and secured instantly at the incident scene or from an object recovered at the incident scene, and the specific character of the activity, which is, in this case, the visual inspection of this site or an object originating in the incident scene, results in the police officer's being obligated to include the following in the visual inspection report:

- location of the trace,
- identify the carrier (object) of the trace,
- describe the physicochemical characteristics of the trace,
- specify the method of recovering the trace,
- specify the way of securing the trace,
- make photographs, a drawing, give a number to the trace using the appropriate label[12].

Afterwards, the reference material, which will be used for comparative tests with the previously secured biological material, is collected and secured. In this regard, it is required that a record be made under Art. 143 § 2 CCP. The lack of such a record may result, from the perspective of the Polish criminal procedure, in a basis for contesting the regularity of the taking of the evidence. The guidelines on examining or performing activities involving the accused and the suspect should also be followed. For example, the collection of the reference material can only be performed by a doctor who has the title of specialist in the field of medicine appropriate to the scope of the examination, and the collection is performed under conditions that ensure the safety and freedom of expression of the person examined. The criminal procedure authority is also obliged to inform the examined person about the purpose and scope of the examination or about the type of activity, as well as to inform about the alleged act in connection with which this examination is carried out.[13]

With respect to the second question, i.e. what formal requirements the sender has to meet so that we can consider the material sent to us "legal", it is right to emphasize that, as a general rule, the sender of an evidential or reference material should recover, collect, secure and transport the forensic material in the first place according to the best forensic practices and knowledge in the field of forensic medicine. Obviously, general process requirements should also be fulfilled, as applicable to the Polish legal culture. In other words, evidential material should be recovered, and reference material should be collected in keeping with general principles as applicable to the

11 Guidelines No 3 of the Police Commander in Chief of 30 August 2017 on the performance of certain investigative activities by police officers.

12 I. Bogusz, M. Bogusz, *Technika kryminalistyczna. Ślady biologiczne*, Centrum Szkolenia Policji, Zakład Szkoleń Specjalnych, Legionowo 2013.

13 Regulation of the Minister of Justice of 23 February 2005 on the examination or performance of activities involving the accused and the suspect (Journal of Laws No 33, item 299).

Polish legal framework (it is, in particular, about the need to preserve the prohibition against the fruit of the poisonous tree). Next, it should be remembered that certain formal requirements must be satisfied as regards marking of evidential and reference material, primarily in such a way as to avoid a situation that implies a risk of disclosing personal data of any persons concerned or disclosing the secrets of an investigation.

Summing up, it is right to emphasize that the cross-border procedure of transporting evidential materials and reference materials is currently regulated in a quite general way. There are no detailed regulations that could be treated as a kind of operating manual. Still, such a state of affairs must not be claimed incorrect. The lack of detailed guidelines of normative and binding character should not be evaluated as an undesirable state. It seems that due to the variety of evidential material that may be transported (biological traces being secured at the scene of an incident, or ones collected for comparison purposes), this issue should be left to the discretion of experts in forensic science and forensic medicine.

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Guidelines No 3 of the Police Commander in Chief of 30 August 2017 on the performance of certain investigative activities by police officers.

Regulation of the Minister of Justice of 23 February 2005 on the examination or performance of activities involving the accused and the suspect (Journal of Laws No 33, item 299).

Regulation No 10 of the Police Commander in Chief of 7 May 2015 on the manner of handling forensic materials and the procedure for creating and maintaining forensic collections in the Police forensic laboratories.

THE EXPERT WITNESS AND THE EXPERT WITNESS'S OPINION IN THE CRIMINAL PROCEDURES OF GERMANY AND POLAND

THE EXPERT WITNESS IN THE CRIMINAL PROCEDURE

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The expert witness as a source of evidence in the criminal procedure often plays an essential role in the process of investigating the truth. If it were not for his/her knowledge, material elements of a case would not frequently be established, that affect a decision, as issued. The legislator regulates the expert witness issues in the Code of Criminal Procedure, yet a legal definition is not provided anywhere in the text of the act. Therefore, following the definition as indicated in the dictionary of the Polish language: *Słownik Języka Polskiego*,[1] the expert witness is a person appointed by the court to give an opinion within the scope of the specialist knowledge at his/her disposal. Within the procedural meaning, on the other hand, the expert witness is deemed to be a person who has been appointed by a process body to establish circumstances of material significance for a decision, that require special knowledge. Judicial decisions of the Constitutional Tribunal provide that the expert witness is a person who has theoretical or practical special knowledge as an authority in a given field, most frequently confirmed by a relevant document.[2] One can distinguish expert witnesses as well as *ad hoc* experts who are appointed for a specific case. Opinions given by both have the same probative value, as will be referred to further. Due to the framework of the study, the question of an opinion given by a scientific or expert institution will be disregarded.

Due to the significance of the institution of the expert witness, the issue is not devoid of controversy, since it is pointed out that the access to the "profession" of an expert witness is regulated too little, hence it can be exercised *de facto* by persons who do

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1 https://sjp.pwn.pl/szukaj/bieg%C5%82y%20s%C4%85dowy.html (access on 2.12.2019).

2 Judgement of the Constitutional Tribunal of 12 June 2008, K 50/05, Journal of Laws 2008 No 107, Item 687.

not possess specialist, required knowledge in the field in which they give opinions,[3] which, then, has consequences related to the possibility of passing an unfair judgement, based on false grounds.

With reference to the definition of the expert witness, the doctrine points out the need for two elements to coexist: a material one, referring to the requirement of having special knowledge, and a formal one, related to the mode of appointing the expert witness in the process for a given purpose.[4]

General information about expert witnesses

Expert witnesses are appointed by the president of a regional court (Art. 157 § 1 of the Act of 27 July 2001 – the Law on the System of Common Courts[5]) for a period of 5 years for respective branches of science, technology, art and other abilities (§ 1 and 2 of the Ordinance of the Minister of Justice of 24 February 2005 on expert witnesses).[6] The expert witness can be appointed for more than one regional court, but on the assumption that it is justified by the interest of the judiciary, which becomes relevant in a situation when we deal with expert witnesses in narrow and rare specialties.[7] Being entered on a number of lists has, however, consequences for the expert witness as well, since he/she must fulfil the duties as imposed on him/her in case of being appointed by a body.

The authority of the president of a regional court to appoint expert witnesses implies the obligation of competent assignment of an expert witness to a given specialty and field, which, in practice, is reflected in the keeping of lists of the so-called permanent expert witnesses. The competent classification of expert witnesses is relevant upon selection of an expert witness by the adjudicating court at the stage of pending court proceedings.[8]

The criteria which must be met by a person in order to become an expert witness include, as follows:

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3 See: T. Tomaszewski, *Dylematy polskiej ustawy o biegłych. Księga dedykowana dr Ewie Weigend*, "Czasopismo Prawa Karnego i Nauk Penalnych" 2011 Year XV, pp. 305-306; T. Tomaszewski, *Kwalifikacja biegłych wydających opinie kryminalistyczne*, "Problemy Współczesnej Kryminalistyki" 2000, Vol. III, pp. 354-355; E. Gruza, *Błędy w opiniach biegłych*, "Problemy Współczesnej Kryminalistyki" 2005, Vol. IX, pp. 18-19.

4 Commentary to Art. 193 CCP, J. Skorupka (ed.) 2019, Issue 31/D, Legalis.

5 Journal of Laws 2015, Item 133.

6 Journal of Laws No 15, Item 133.

7 Judgement of the Provincial Administrative Court in Warsaw of 26 June 2007, File No VI Sa/Wa 1549/06, LEX No 352767.

8 See: K. Flaga-Gieruszyńska (ed.), *Biegły w postępowaniu cywilnym i karnym. Komentarz praktyczny z orzecznictwem. Wzory pism procesowych i orzeczeń*, Warszawa 2017, p. 235.

- ability to exercise full civil and public rights,
- being 25 years of age,
- having theoretical and practical special knowledge in a given branch of science, technology, art, craft and other abilities for which he/she is to be appointed,
- giving assurance of due performance of the expert witness's duties,
- expressing consent to being appointed an expert witness,
- the possession of special knowledge must be demonstrated by documents or other evidence.

The verification of a person applying to be entered in the list of expert witnesses takes place only based on documents, as presented by the same, which are verified by the president of the regional court. This is the only possible solution with respect to making a candidate's assessment. The presented documents confirm an adequate level of professional qualifications[9],however, the president of the court himself/herself does not have other tools so as to be able to make an assessment of the skills to have been presented. It would seem that graduation from a higher education institution could predestine the candidate to be entered in the list of expert witnesses – however such an element would only be the fulfilment of the criterion of having theoretical knowledge which is often insufficient from a practical point of view to give an opinion in a specific case, based already on a particular case study.

The notion of assurance of due performance of the expert witness's duties is defined as the entirety of traits, events and circumstances pertaining to the person of an expert witness, creating his/her image as a person of public trust.[10] This image is composed of such character traits as fairness, integrity, conscientiousness and impartiality jointly.[11] There is not a legal definition of the notion of "assurance of due performance of the expert witness's duties," therefore the position of administrative judiciary plays an essential role as regards its understanding.

The obligation of giving assurance by an expert witness is executed by means of the requirement to append a certificate of lack of a criminal record from the National Criminal Register. The appending of the certificate is justified since, according to a well-established view in the judicature: a final and valid judgement of conviction against an expert witness for his/her committing an offence allows for an assumption

9 A. Klich, *Dowód z opinii biegłego w postępowaniu cywilnym. Biegły lekarz*, Warszawa 2016, p. 129.

10 Judgement of the Provincial Administrative Court in Warsaw of 18 October 2006, VI SA/Wa 1553/06, LEX No 264553.

11 Judgement of the Provincial Administrative Court in Warsaw of 23 April 2008, VI SA/Wa 140/08, LEX No 498390.

that he/she does not fulfil the basic condition for acting in this capacity – assurance of due performance of the expert witness's duties.[12]

The possession of special knowledge, that a person with average education does not possess, is an absolute prerequisite for appointing a person as an expert witness, however, this requirement is underregulated since its only verification consists in presenting documents by a candidate for an expert witness, which documents are assessed by the president of a regional court, even though he/she is often not familiar with the specific character of a given specialty in which the person is to be appointed as an expert witness. Beside substantive competencies, social skills are important, which supports the thesis that it is not only substantive knowledge and professional experience that is important in the process of opinion-giving.[13] The possession of special knowledge is not a matter of a given person's having a formal education, but relevant expertise in the discipline in question.[14]

The Polish Code of Criminal Procedure does not better and worse evidence, yet it should be emphasized that expert witnesses' opinions, due to the fact that they come from independent persons who are not interested in the conclusion of a case, are of material significance to process bodies.[15]

An expert witness's opinion, as distinguished from other means of evidence of personal character, does not present a picture of a fact, but expresses a judgement about a datum of significance for a determination in the subject matter of the proceedings. It can be influenced – to the detriment of material truth – by intuition, as well as routine, a kind of established cognitive and consultative schematism. Therefore, an expert witness should be someone who not only has undisputed knowledge in a field, but also is fully responsible and inspires an adequate level of trust.[16]

Moving to the regulations contained in the Code of Criminal Procedure, pursuant to Art. 193 § 1 CCP, if the ascertainment of circumstances of material importance for the determination of a case requires special knowledge, an opinion of an expert witness or expert witnesses is sought. Such a categorical statement by the legislator provides that in a situation when a need occurs to use special knowledge, a process body is obligated to appoint an expert witness. Special knowledge is one that goes beyond average skills of an adult person of adequate life experience, education and

12 Judgement of the Provincial Administrative Court in Warsaw of 30 March 2007, File No VI SA/Wa 119/07, LEX No 335193; Judgement of the Provincial Administrative Court in Warsaw of 11 January 2006, File No VI SA/Wa 1976/05, LEX No 206569.

13 K. Flaga-Gieruszyńska (ed.), *Biegły w postępowaniu cywilnym i karnym…*, pp. 261-262.

14 P. Karasek, P. Rybicki, "Sposoby oceny kompetencji biegłych sądowych", in: B. Lewandowski (ed.), *Pozycja biegłego w polskim systemie prawnym*, Warszawa 2016, p. 179.

15 K. Flaga-Gieruszyńska (ed.), *Biegły w postępowaniu cywilnym i karnym…*, Warszawa 2017, p. 478.

16 D. Wysocki, "Opinia biegłego: czym jest, czym być (nie) powinna?", in: B. Lewandowski (ed.), *Pozycja biegłego…*, p. 14.

amount of general knowledge, as well as normal, generally available in the society, knowledge in the scope of science, art, technology or craft.[17]

Evidence from an expert witness's or expert witnesses' opinion is required when two prerequisites occur: firstly, there is a necessity to ascertain circumstances of material importance for the determination of a case, secondly, the ascertainment of these circumstances is based on findings requiring special knowledge. An expert witness's opinion concerns issues that would be impossible or much more difficult to learn directly by the process body due to the need to possess special knowledge.[18]

The knowledge that a process body possesses must not constitute evidence in the case, hence it cannot replace an expert witness's opinion. This knowledge only enables and facilitates the evaluation of evidence from an expert witness's opinion.[19] A process body cannot abandon an expert witness's opinion if the establishment of a fact requires special knowledge. Neither can it reject all specialist opinions and adopt in a given case its own, different standpoint.[20] Cumulation of the process roles of a process body and an expert witness is inadmissible.[21] In line with the prime principle of the criminal procedure – evaluation of evidence (Art. 7 CCP) and jurisdictional independence of the court (Art. 8 CCP) – a process body makes independent findings, and an expert witness's opinion constitutes one of the items of evidence that may, but does not have to, provide the bases for a decision, as taken. The expert witness is an assistant in the proceedings, and his/her opinion, as every item of evidence, can be contested by the process body.[22]

When evaluating evidence, there is the necessity of having regard to the principle of correct thinking. The principle of free evaluation of evidence must not lead to arbitrary assessment and demonstrate factual errors and logical fallacies.[23] A process body, in its evaluation of an expert witness's opinion, has an obligation to review the logical course of the rationale behind the opinion and verify its results on the basis of the evidentiary material of the case.[24]

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17 D. Drajewicz, "Weryfikacja biegłego i jego opinii w postępowaniu karnym", in: B. Lewandowski (ed.), *Pozycja biegłego…*, p. 52; D. Drajewicz, *Ocena opinii biegłego w postępowaniu karnym*, "Przegląd Sądowy" 2014, Vol. 6, p. 76; T. Tomaszewski, *Dowód z opinii biegłego w procesie karnym*, Kraków 2000, p. 9; Judgement of the Supreme Court of 15 April 1976, File No II KR 48/76, OSNKW 1976, Vol. 10-11, Item 133.

18 W. Grzeszczyk, *Rola opinii biegłego*, "Prokuratura i Prawo" 2005, Vol. 6, p. 30.

19 T. Grzegorczyk, *Kodeks postępowania karnego oraz ustawa o świadku koronnym. Komentarz*, Warszawa 2008, p. 448.

20 Judgement of the Supreme Court of 2 March 2017, II KK 358/16, Legalis; cf. also Judgement of the Administrative Court in Katowice of 10 February 2016, II AKa 421/15, Legalis.

21 T. Tomaszewski, *Dowód z opinii biegłego w procesie karnym*, Kraków 2000, p. 10.

22 D. Drajewicz, *Ocena opinii biegłego w postępowaniu karnym…*, p. 76.

23 Judgement of the Supreme Court of 5 September 1974, File No II KR 114/74, LEX No 18929.

24 Judgement of the Supreme Court of 12 October 2006, File No IV KK 236/06, LEX No 295215.

Pursuant to Art. 193 § 3 CCP, a process body may appoint expert witnesses in various specialties, as well as it is the decision of the process body whether they are to conduct research in collaboration and give one joint opinion, or separate opinions. A complex opinion is grounded if a great number of fundamental problems emerge in a case that call for a complex study and positions to be taken by expert witnesses of various specialties and in various fields of knowledge. Developing a joint opinion, in principle, neither excludes nor limits the independence of each expert witness within the scope of the discipline that he/she represents.[25]

According to Article 195 CCP, one can distinguish expert witnesses as well as ad hoc experts, thus allowing the appointment, in the capacity of an expert witness, of persons having adequate knowledge in a given discipline but not entered in the list of expert witnesses kept by the president of a regional court.[26] Every person can be appointed an expert if he/she has relevant professional and specialist qualifications in a given field, and there are no reservations as to his/her impartiality. There is no difference in dealing with and evaluating an opinion filed by an expert witness or another expert appointed in a specific case by a process body.[27] None of the regulations of the Code of Criminal Procedure provides that a person appointed as an expert should appear on the list of expert witnesses, but it will suffice that he/she has relevant qualifications and knowledge in the discipline to which the subject matter of the expert opinion pertains.[28] A specific person becomes an expert witness upon being appointed by a process body. In case of a court, this occurs upon the pronouncement of the decision in trial proceedings, or alternatively, following its signature at a sitting. At the stage of preparatory proceedings, on the other hand, this occurs upon its signature by the attorney, police officer or another body conducting the proceedings. It does not suffice to send the file requesting a specific opinion to be drawn up, it is necessary that an authorized process body issue a decision in which the expert witness and subject matter of the opinion are specified unequivocally.[29]

The basis for trusting every expert witness is the conviction of his/her objectivity and possession of necessary special knowledge.[30] An expert witness's evaluation criteria should be of objective character, referring to his/her reliability, the skill of versatile thinking and drawing unbiased conclusions, or due distancing form the issues

25 T. Grzegorczyk, *Kodeks postępowania karnego. Komentarz*, Vol. I, Warszawa 2014, pp. 694-695.

26 Judgement of the Supreme Court of 26 April 2006, File No WA 15/06, LEX 294285.

27 Judgement of the Supreme Court of 5 February 1974, File No III KR 371/73, OSNKW 1974, Vol. 6, Item 117.

28 Judgement of the Supreme Court of 19 September 1988, I KR 279/88, OSNKW 1988, Vol. 11–12, Item 80.

29 K. Flaga-Gieruszyńska (ed.), *Biegły w postępowaniu cywilnym i karnym*…, p. 497.

30 Judgement of the Supreme Court of 17 March 1980, File No I KR 12/80, OSNPG 1980, Vol. 11, Item 135.

in question, the subject matter of the proceedings or participants therein,[31] therefore the legislator has created a catalogue of entities that must not be expert witnesses due to the character of activities they perform or their relation to the parties (Art. 196 CCP).

The role of the expert witness in the criminal procedure cannot be reduced to the role of a witness, still, despite this fact, according to Art. 197 § 3 CCP, relevant witness regulations apply to the expert witness, as follows:

1. An expert witness has an obligation to appear and submit an opinion (Art. 177 § 1 CCP).
2. An expert witness's questioning may occur by means of technical devices enabling the performance of this act on a remote basis with simultaneous transmission of picture and sound (Art. 177 § 1a CCP).
3. An expert witness who cannot appear as summonsed due to an illness, disability or another insurmountable obstacle may be questioned in the place of his/her stay (Art. 177 § 2 CCP).
4. An expert witness can invoke the fact of secrecy classified as "Secret" and "Top Secret" (Art. 179 CCP) and "Confidential" and "Restricted" (Art. 180 § 1 CCP), as well as professional and functional secrecy (Art. 180 § 2 CCP), which requires his/her being released there from and questioned in camera.
5. Affirmation from an expert witness may be taken only by the court or a designated judge (Art. 187 § 1 CCP), wherein it can be waived if the parties do not object thereto (Art. 187 § 2 CCP).
6. During the expert witness's making the affirmation, all, including the judges, are standing (Art. 188 § 2 CCP).
7. Upon requestioning, the expert witness is only reminded of his/her previous affirmation or retaken the same (Art. 188 § 4 CCP).
8. Prior to the commencement of the questioning, the expert witness shall have been forewarned about the criminal liability for submitting a false opinion (Art. 190 § 1 and 2 CCP).
9. The questioning commences with asking the expert witness his/her first name, surname, age, occupation, conviction for making a false statement or accusation and relation to the parties which is relevant to establish whether there are grounds for exclusion of the expert witness under Art. 196 § 1 CCP (Art. 191 § 1 CCP).

31 Decision of the Supreme Court of 22 July 2015, File No IV KK 114/15, LEX No1794321.

Appointment of an expert witness in a case

Admission of evidence from an expert witness's opinion takes place by means of a decision which is non-actionable and in which the following must be provided:

- the first name, surname and specialty of the expert witness or expert witnesses, and in case of an institution's opinion: the specialties and qualifications of the persons who should participate in the effecting of the expert opinion,
- the subject matter and scope of the expert opinion with the formulation, if need be, of specific questions,
- the expert opinion delivery date.

A necessary prerequisite for recognizing an expert's written statement as an opinion is not only the drawing up the same by an expert witness, but also preceding it by a decision of a process body to consult this person as an expert. It is then only upon the issuance of a decision to appoint an expert witness for the purpose of drawing up an opinion, he/she becomes a participant in the proceedings, whereas the opinion given by him/her is afforded the qualities of an opinion within the meaning of the criminal procedure regulations.[32]

In order that an expert witness's opinion could fulfil its evidentiary function properly, it is necessary to specify the task to be ordered to the expert witness. It is mandatory that the process body state the subject matter and scope of the expert opinion in the decision, and, as necessary, also detailed questions. The subject matter of an expert opinion is assumed to include issues regarding a particular field of knowledge, that pertain to circumstances of material importance for the determination of the case. The notion of the scope of an expert opinion, on the other hand, comprises the purpose of the expert opinion, the definition of the evidentiary material to be examined, as well as, in the case of certain expert opinions, the definition of the reference material, and, in addition, the way of conducting the examination and the questions which the expert witness is to determine.[33]

Questions asked to an expert witness should be formulated in such a way so that their contents leave no doubt as to the enquirer's intentions. These are questions of a type that are feasible for the appointed expert to give an answer to. Rules have been developed in the doctrine as regards formulating questions to ask experts, which include as follows:

- prohibition on questions going beyond the field of knowledge that is represented by a given expert witness,

32 Decision of the Supreme Court of 24 January 2008, File No II KK 290/07, Bull. 2008, Vol. 3, p. 32.

33 Z. Kegel, "O właściwe pojmowanie ustawowych pojęć – 'przedmiot' i 'zakres' ekspertyzy", in: Z. Kegel, *Problematyka dowodów z ekspertyzy dokumentów*, Vol. II, Wrocław 2002, p. 892; J. Żylińska, *Określenie przedmiotu i zakresu ekspertyzy w postanowieniu o powołaniu biegłego*, "Nowa kodyfikacja prawa karnego", Vol. XIV, p. 170.

- obligation to ask questions in an orderly way according to their logical content,
- formulation of questions in a comprehensible manner,
- avoidance of unintelligible terms in the formulation of questions,
- prohibition against combining a question relating to matter-of-fact issues with legal ones[34].

The time limit for the drawing up of an opinion is of an instructional character for the process body, and of a disciplining one for the expert witness. Failure to keep it does not produce any procedural effects. An opinion submitted after the deadline, still remains an opinion that constitutes evidence to be evaluated in line with general rules.[35] In order to force an expert witness's keeping within the time limit, financial disciplinary penalties can be applied. If, however, an expert witness has executed his/her opinion, as ordered, even with considerable delay, which he/she has not excused, there are no more reasons to impose such a penalty since there is not anything to force out of him/her anymore.[36]

An expert witness, in a situation when any files as presented to him/her do not contain essential, from his/her point of view, documents for giving a dependable opinion, may apply that such part should be provided to him/her wherein such material is found. The expert witness is also given the evidentiary initiative to notify the process body of a necessity to supplement the evidentiary material. This can include, among others, a supplemental hearing of a witness or hearing of an additional witness, as well as obtaining other material evidence.[37]

An opinion submitted by an expert witness may have an oral or written form, depending of the process body's will. Irrespective of the form that the expert witness's opinion will assume, it has the same probative value. The value of an expert witness's work as put into the substantive elaboration of a specialist opinion may not be assessed on the basis of the volume to be submitted in writing or orally at a trial. Its value is determined by the type of the case and the scope of the evidentiary material being the subject matter of the process of opinion-giving, the labour consumption of individual activities performed by the expert witness and his/her qualifications to ascertain circumstances of material importance for the determination of a case, the subject matter and scope of the opinion as entrusted there to, as well as the reliability, punctuality and kind of technical devices used to prepare and elaborate the opinion.[38]

An expert witness's opinion must consist of the following elements in order that it can be considered full and complete:

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34 T. Tomaszewski, *Dowód z opinii biegłego w procesie karnym*, Kraków 2000, pp. 66, 70.

35 K. Flaga-Gieruszyńska (ed.), *Biegły w postępowaniu cywilnym i karnym…*, p. 492.

36 T. Grzegorczyk, *Kodeks postępowania karnego…*, 2014, p. 697.

37 K. Flaga-Gieruszyńska (ed.), *Biegły w postępowaniu cywilnym i karnym…*, p. 513.

38 Ibidem, pp. 529-530.

- the first name, surname, academic degree and title, specialty and professional position of the expert witness,
- the first names, surnames and remaining data of other persons who have participated in the carrying out of the expert opinion, with the specification of the activities to have been performed by each of these persons,
- in case of an institutional opinion – also the full name and seat of the institution,
- the time of the examination, as carried out, and the date of the giving of the opinion,
- a report of the activities and observations to have been carried out and conclusions as based thereon,
- the signatures of all expert witnesses who have participated in the giving of the opinion.

The catalogue as described in Art. 200 § 2 CCP is an open one which offers an expert witness the possibility to include additional considerations and special information in the opinion.

The critical element of an opinion is a report of the activities and observations to have been carried out and conclusions as based thereon. An opinion should contain the description of methods and manner of the carrying out of the examinations, the definition of the order in which they have been carried out, and adduce all arguments based on ascertained circumstances that are related to the facts to have been examined, which are underpinned by the expert witnesses' competent explanations.[39]

On the formal plane, the court, and in the preparatory proceedings – the ordering body, should make an assessment whether the opinion contains all the necessary elements, such as the reporting part (regarding an analysis of the case files and examination to have been carried out) and the reasoning of the opinion completed with the presentation of final conclusions. A written position of an expert witness that is limited to the presentation of his/her own observations and conclusions (without a report of the conduct of examinations and the reasoning which provided the basis for the drawing of the conclusions) is not an opinion at all within the meaning of the procedure. The formal conditions of an opinion refer to the expert witness's qualifications as well, since beside adequate professional predispositions and experience, the process body should also inspect whether the expert witness has not exceeded his/her competence and whether there are grounds for his/her exclusion.[40]

In the course of the conduct of a case, following an expert witness's delivery of a written opinion, the necessity may arise to supplement an option, once given, then it must be assumed, in line with the principle of orality, contradictoriness and right to

39 K. Flaga-Gieruszyńska (ed.), *Biegły w postępowaniu cywilnym i karnym…*, p. 531.

40 S. Ładoś, "Ocena opinii biegłego psychologa w postępowaniu karnym", in: *Pozycja biegłego w polskim systemie prawnym*, B. Lewandowski (ed.), Warszawa 2016, p. 65.

defence, that the expert witness should be heard in the case, especially if it is required by the weight of the case or if the parties move there for due to the need to ask questions to specify any statements as contained in the opinion that are not clear for them or that, in their opinion, lack an answer.[41]

Evaluation of an expert witness's opinion

An opinion must be evaluated comprehensively, an evaluation should be performed of both a written opinion and an oral one.[42] The evaluation must take into account not only compliance with the principles of logic, but also general knowledge, the level of knowledge of the expert witness, the theoretical foundations of the opinion, the method of the reasoning and the level of resolution of the conclusions as expressed in it, the exhaustiveness of materials comprising its basis, the correctness of research methods as applied and adopted ways of inferring.[43]

An opinion does not fulfil its function if it is incomplete and unclear. An opinion is incomplete if it does not provide answers to all questions asked to the expert witness to which, according to the scope of specialist knowledge and materials, as made accessible to him/her, he/she may and should give answers, or if it does not take into account all circumstances that are important for the determination of a specific issue, or if it does not contain the grounds for the considerations and views to be expressed therein.[44] However, an opinion is complete if, on the one hand, it answers all questions included in the decision, and on the other it is based on all evidence, as available and collected in the case, and its reporting part describes all examinations to have been carried out, as necessary, and, at the same time, none of the research methods has been disregarded.[45] An opinion can be considered incomplete also when the expert witness ignores evidence to have been recovered in the course of the proceedings, or if the opinion contains only conclusions, without the presentation of the premises on which basis the expert witness has formulated these conclusions.[46] The fact itself that an opinion is short does not mean that it is incomplete, particularly if it is supplemented orally at a trial, since an evaluation of the opinion takes into account its entirety, that is both the written part and the oral one.[47]

41 T. Grzegorczyk, *Kodeks postępowania karnego. Komentarz…*, 2014, p. 712.

42 Decision of the Supreme Court of 1 October 2004, File No III KK 28/04, LEX No 126705.

43 Judgement of the Administrative Court in Łódź of 27 July 2006, File No II AKa 136/06, LEX No 274039; Judgement of the Supreme Court of 21 June 1971, File No III KR 18771, OSNPG 1972, Vol. 2, Item 33; Judgement of the Supreme Court of 28 May 2001, LEX No1839.

44 Decision of the Supreme Court of 22 October 2009, File No III KK 239/15, LEX No 1820402.

45 K. Flaga-Gieruszyńska (ed.), *Biegły w postępowaniu cywilnym i karnym…*, p. 537.

46 Decision of the Supreme Court of 20 April 2016, File No III KK 132/16, Legalis.

47 T. Grzegorczyk, *Kodeks postępowania karnego…*, p. 716.

According to judicial decisions, an incomplete opinion occurs in particular, when it:
- disregards evidence which was important for its development,[48]
- is based on insufficient evidentiary material,[49]
- does not include grounds for the rejection of the results of auxiliary examinations, e.g. from a psychological assessment,[50]
- ignores necessary research results,[51]
- contains only a conclusion, without providing the premises which have led thereto,[52]
- in road accident cases, does not take into account all possible variants of the causes and course of this event.[53]

An opinion is unclear if its wording does not allow for the understanding of the considerations and views as expressed therein and the manner of reaching these, or is self-contradictory or uses illogical arguments,[54] and also when conclusions, as derived there from, are not sufficiently legible and understandable. It may result from an inadequate choice of linguistic forms used or the complexity of the matter, thence a multiplication of specialist terminology. The unclarity of an opinion may also depend on not having translated all effects of the acts and observations, as performed, into the final results.[55] The expert witness's lacking clear reasoning may be a basis for contesting the opinion due to the fact that the final conclusions are illogical, inaccurate, and it is impossible to establish the expert witness's position in a given case. Final conclusions must always lean on examination to have been carried out.[56]

An irresolute opinion is not to be disqualified if there is an objective inability to give the same due to the current state of the art, lack of adequate research or scientific methods being developed, or significantly distinctive identification features being

48 Judgement of the Supreme Court of 9.5.1988, II KR 96/88, OSNKW 1988, Vol. Vol. 9-10, Item 72; Judgement of the Supreme Court of 24.1.1986, IV KR 355/85, OSNPG 1987, Vol. 3, Item 37.

49 Judgement of the Supreme Court of 8.8.1980, IV KR 152/80, Legalis; Judgement of the Supreme Court of 8.6.1988, V KRN 59/88, OSNPG 1989, Vol. 1, Item 15; Judgement of the Supreme Court of 8.1.2002, IV KKN 646/97, Legalis.

50 Judgement of the Supreme Court of 6.9.1979, Rw 198/79, OSNKW 1980, Vol. Vol. 1-2, Item 9.

51 Judgement of the Supreme Court of 12.5.1988, II KR 92/88, OSNPG 1989, Vol. 2, Item 35.

52 Judgement of the Supreme Court of 12.3.1979, I KR 27/79, OSNPG 1979, Vol. 10, Item 138; Judgement of the Supreme Court of 30.9.1982, I KR 228/82, OSNPG 1983, Vol. 4, Item 47; likewise Judgement of the Supreme Court of 13.10.1998, II KKN 225/99, unpublished; see also: A. Gaberle, *Dowody w sądowym procesie karnym*, Warszawa 2010, p. 115.

53 Judgement of the Supreme Court of 21.10.1980, Rw 361/80, OSNKW 1981, Vol. 1, Item 7; likewise Judgement of the Supreme Court of 8.1.2002, IV KKN 646/97, Legalis.

54 Judgement of the Supreme Court of 7 October 2009, File No III KK 122/09, LEX No 532391.

55 K. Flaga-Gieruszyńska (ed.), *Biegły w postępowaniu cywilnym i karnym…*, p. 538.

56 S. Ładoś, "Ocena opinii biegłego psychologa w postępowaniu karnym"…, p. 69.

established, finally, material under scrutiny may be too meagre, which could not have been supplemented.[57]

An expert witness's opinion is subject to free evaluation of evidence, like any other evidence in a case, it is important that an opinion should:

- meet the requirements of modern knowledge,
- be prepared faultlessly in terms of methodology,
- drawn up by an expert witness who has adequate knowledge, competence and is reliable,
- be complete, that the materials providing the basis for the opinion should be complete,
- be clear, not contain any inconsistencies and unknowns.

In other words, the assessment of an expert witness's opinion should consider, as follows:

1. Whether the expert witness has at his/her disposal special knowledge as necessary to ascertain given circumstances.
2. Whether the opinion is logical, that is not self-contradictory, and compatible with the principles of life experience.
3. Whether it is complete and clear.
4. Whether it is not in contradiction with another opinion as recovered in the proceedings.[58]

An expert witness's opinion is examined by the court and it is the latter who decides whether it is understandable and convincing thereto, whether it answers the questions defining its subject matter and limits, whether it is internally coherent and consistent, whether it does not raise doubts as to its substantive accuracy. If the court has had reasonable doubts in any of the above questions, then the court decides to summon the same expert witnesses, confront experts or appoint other expert witnesses.[59]

Verification of opinions may take place *ex officio* or at the request of a party, this being, in fact, an application for taking evidence within the meaning of Art. 169 CCP. In case a process body does not share the arguments contained in an application for supplementation of expert witnesses' opinion or for appointment of new expert witnesses, then it issues a decision to dismiss the application. The basis for the dismissal of an application is Art. 201,and not Art. 170 § 1 CCP. As stems from a well-established case law, in case of a party's application, Art. 170 § 2 CCP does not apply, either, since this matter is regulated in its entirety in the provision of Art. 201 CCP.[60]

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57 T. Tomaszewski, *Dowód z opinii biegłego…*, pp. 119-120.

58 T. Grzegorczyk, *Kodeks postępowania karnego…*, 2014, p. 715.

59 Judgement of the Administrative Court in Wrocław of 17 February 2016, File No II AKa 13/16, Legalis.

60 Judgement of the Administrative Court in Kraków of 24.5.2001, II AKa 58/01, KZS 2001, Vol. 7-8, Item 49; Decision of the Supreme Court of 19.3.2002, V KKN 150/00, Legalis.

Conclusion

The source of evidence being the expert witness, as has been demonstrated, is a necessary link for the conclusion of a case in accordance with the principles which rule the criminal procedure, as well as in connection with the necessity to implement the principle of social justice. The expert as a person who has specialist knowledge in a given field is the entity who, by being introduced into the process and referred to the case under consideration, enables the process body to take a correct decision. Therefore, it is important that a person who exercises this function should possess adequate education, knowledge of the relevant discipline, as well as experience, not only in professional, but also practical terms. In addition, such a person should also be characterized by reliability, conscientiousness and accuracy in the performance of his/her actions, which should also be translated into an opinion to be given thenceforth. It need be postulated, as well, that the system of verification of expert witnesses should be subject to certain standards, since presently the verification of submitted documents relies solely on the president of a court which, as has been demonstrated, is not always sufficient to prevent situations when persons are entered in the list of expert witnesses who practically do not possess special knowledge, whereas presented documents do provide a guarantee of actual abilities. That is why it would be justified to regulate this matter by a separate legal act that would control these issues in a detailed and comprehensive manner, specifying who exactly may be an expert witness, by what knowledge and abilities he/she should be characterized, with the identification of documents that must certify the same; also, an obligation would be contained there for expert witnesses to constantly improve their qualifications, which, nowadays, is a necessary prerequisite for staying on the commercial services market.

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DNA ANALYSES IN GERMANY – LEGAL CONSIDERATIONS. OVERVIEW OF CRIMINAL PROCEEDINGS AND DNA ANALYSES: PREREQUISITES, LIMITS AND POSSIBILITIES

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The article aims to outline the possibilities that molecular genetic analyses offer in the context of criminal proceedings in Germany and the legal bases must be observed. To this end, the relevant case law and selected current literature were evaluated. As a result, it was demonstrated that the significance of the DNA analysis in criminal proceedings is continuously growing, which can be explained as the result of immense scientific progress in this area. The general legal principles in the German Code of Criminal Procedure (*Strafprozessordnung*, CCP) regularly have a limiting effect on the use of molecular genetic analyses, which can be seen, however, as appropriate and necessary due to the high relevance of fundamental rights. The presentation concludes with an outlook on possible innovations.

Introduction

DNA analyses have been used in criminal proceedings in the Federal Republic of Germany since the end of the 1980s.[1]

The examination of trace material is simply about whether a DNA profile analysed from a trace can be assigned to a specific person. As a result of the insights gained from this examination persons, who are suspected of having left the traces can be excluded or not excluded, with in particular the secure exclusion of a person as

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1 M. Rath, B. Brinkmann, "Strafverfahrensänderungsgesetz – DNA-Analyse ("Genetischer Fingerabdruck") und DNA-Identitätsfeststellungsgesetz aus fachwissenschaftlicher Sicht", in: *Neue Juristische Wochenschrift (NJW)* 1999, p. 2698.

a suspected offender being a significant innovation. Such examinations relating to the non-coded sequence of DNA[2] and the use of the examination results for evidentiary purposes were considered admissible in academic literature and case law even without a special statutory authorisation in the Code of Criminal Procedure.[3] At the same time, the effectiveness of DNA analysis associated with technological progress increased its importance for criminal proceedings, turning it now into an integral and virtually indispensable part of the practice of criminal prosecution.[4] In view of this increasing relevance, the legislator acted, primarily to ensure the appropriate use of the screening material: in 1997, they introduced section 81e CCP to establish requirements for this intervention on the part of the authorities as well as limits for the admissibility of molecular genetic analyses in specific statutory authorisations.[5] Subsequently, the provisions enshrined in sections 81e–81h have been regularly updated, primarily to adapt the legally envisaged application options to the technical state of the art.[6]

Main section

DNA analysis pursuant to sections 81e et seqq. CCP

DNA analyses according to sections 81e et seqq. CCP are designed for two fundamentally distinguishable applications, namely their use as evidence in ongoing criminal proceedings and the determination of the identity of persons currently concerned also in future proceedings on the other hand:

Evidence in ongoing criminal proceedings

When used as evidence in criminal proceedings, molecular and genetic analyses of human cell tissue serve to clarify whether detected trace material (reference material) is consistent with the material taken from the accused or aggrieved party.[7] As a result, the person who has left the traces can be identified or excluded with a high degree of probability. On the one hand, the probative value of matching findings for the judicial proceedings must be deemed to be very high because of their scarcity being in the millions (as a result of the standardization of molecular genetic testing

2 Judgment of the German Federal Court of Justice in Criminal Matters, BGHSt 37, p. 157 et seqq.

3 M. Goers, "§ 81e", in: *BeckOK StPO*, 39th ed., Munich 01/01/2021, para. 1-2.

4 R. Neuhaus, "StPO § 81e", in: *Gesamtes Strafrecht*, D. Dölling, G. Duttge, S. König, D. Rössner (eds.), 4th edition, Baden-Baden, 2017, para. 1.

5 German Federal Legal Gazette 1997 I, p. 534.

6 T. Trück, "StPO§ 81e", in: *MüKoStPO*, 1st edition, Munich 2014, para. 5-6.

7 Sections 81e, 81f of the German CCP.

that has been achieved in the meantime),[8] but on the other hand it cannot be regarded as a given, and a conviction must therefore not be based entirely on their result.[9] It should always be borne in mind that this is a statistical representation, which can also be distorted by various sources of error.[10] As a result, the court must therefore convince itself of the correctness of the procedures used and may not refuse to take other or contradictory evidence into consideration.[11]

From a legal perspective, all cell tissues that have been lawfully obtained by the prosecuting authority may be used as material for analysis.[12] In accordance with the wording of section 81e CCP, this includes in the first place the material taken from the accused or other persons in accordance with section 81a, 81c CCP. According to the prevailing opinion, the taking of a saliva sample by means of cotton swabs is merely a physical examination according to sections 81a(1), sentence 1, 81c(1) CCP[13] and therefore does not need to be conducted by a physician. Notable as an important formal requirement is a fact that the power to order an analysis is assigned primarily to a judge. This power passes to the responsible public prosecution office and its investigators only in exigent circumstances. The object of molecular genetic analyses can also be 'open traces' pursuant to section 81e(2) CCP,[14] in other words, found, secured or seized trace material.

Determination of the identity of the person currently concerned also in future proceedings

In addition, it is also possible to establish the identity of the current accused in future proceedings pursuant to section 81g CCP. The requirements must be classified as quite strict: for example, criminal proceedings must first be conducted from one of the three groups of offences referred to in section 81g CCP. This includes offences of considerable importance, i.e. those which can be classified at least as medium crime, which severely disturb legal peace and are also likely to significantly impair the population's sense of legal certainty.[15] Suitable current offences also include offences against sexual self-determination (section 174b–184f of the German Criminal Code

8 M. Goers, "§ 81e", in: *BeckOK StPO*, 39th ed., Munich 01/01/2021, para. 17.

9 Judgment of the German Federal Court of Justice in Criminal Matters, BGHSt 37, p. 157, at p. 159; BGHSt 39, p. 38, at p. 320.

10 P. Schneider, H. Schneider, F. Fimmers, B. Brinkmann, "Allgemeine Empfehlungen der Spurenkommission zur statistischen Bewertung von DNA-Datenbank-Treffern", in: *Neue Zeitschrift für Strafrecht (NStZ)* 2010, p. 433 et seqq.

11 T. Trück, "StPO § 81e", in: *MüKo StPO*, 1st edition, Munich 2014, para. 28-29.

12 T. Trück, "StPO § 81e", in: *MüKo StPO*, 1st edition, Munich 2014, para. 11-14.

13 BeckRS 2008, 39396.

14 R. Neuhaus, "§ 81e", in: Dölling/Duttge/König/Rössner, *Gesamtes Strafrecht*, 4th edition, Baden-Baden, 2017, para. 2.

15 Judgment of the German Federal Constitutional Court, BVerfGE 103, p. 21, at p. 34.

(*Strafgesetzbuch*, CC)), as well as the so-called other offences, i.e. offences that are neither sexual offences nor offences of considerable importance, but which produce, however, an equivalent unlawful content from the repeated commission.[16] A further prerequisite is that certain facts justify the prognosis that criminal proceedings will have to be conducted against the accused in the future for a criminal offence of considerable importance. The corresponding prognosis of future criminal proceedings must be assessed based on the findings of the present criminal offence and must be measured against the existence of concrete evidence.[17] Ordering a DNA identity determination is also dependent on a basic suspicion (initial suspicion) at the time of the order of the taking of samples and the analysis according to section 81f CCP, which is why the proceedings may not be discontinued in particular due to lack of a sufficient suspicion.[18] Even persons who have already been convicted with final and binding effect are in principle covered by the provision. However, the maximum limit is the period after which a corresponding entry is deleted from the Federal Central Criminal Register (*Bundeszentralregister*) or the Youth Register (*Erziehungsregister*).[19] Section 81g CCP thus represents an authorisation for both the removal and analysis of the material.

Serial DNA screening

Section 81h CCP is the legal basis for serial screening. The screening aims to determine whether any trace material obtained originates from one of the persons invited to participate and voluntary participating in the genetic screening. The execution of a serial genetic screening is only permitted if there is an initial suspicion with regard to one of the crimes against life, limb, freedom or sexual self-determination stipulated in section 81h CCP. In this respect, it is also sufficient to attempt such an act.[20]
The target group of the serial screening may only include persons, who fulfil certain screened characteristics that presumably apply to the offender. Accordingly, an offender profile, created by the prosecuting authorities, is required, which permits a limitation of the group of persons in question based on group-specific characteristics, such as age, gender, place of residence, hair colour, ownership of a particular car.[21] Furthermore, particular attention must be taken to the principle of proportionality in the injunction. In section 81h(1) CCP, the law expressly sets a corresponding

16 M. Goers, "§ 81g", in: *BeckOK StPO*, 39th edition, Munich 2021, para. 5.

17 Judgment of the German Federal Constitutional Court, BVerfGE 103, p. 21; A. Hadamitzky, "StPO§ 81g", in: *Karlsruher Kommentar zur Strafprozessordnung*, 8th edition, Munich 2019, para. 9-10.

18 BeckRS 2019, 12878, para. 4.

19 M. Goers, "§ 81g", in: *BeckOK StPO*, 39th edition, Munich 2021, para. 8.

20 Bundestags-Drucksache 15/5674, p. 13.

21 K. Graalmann-Scheerer, "DNA-Massentest de lege lata und de lege ferenda", in: *Neue Zeitschrift für Strafrecht (NStZ)* 2004, p. 297 et seqq.

point of reference by citing the number of persons affected by the serial screening in relation to the severity of the act to be clarified for the assessment of proportionality.[22] Due to the large number of persons who are not under suspicion affected by a mass genome test and the enormous costs associated with the measure, the proportionality of such a measure, in the sense of an *ultima ratio*, a measure of last resort, will as a rule only be accepted if other investigative measures have proven to be unsuccessful.[23]

The serial genetic screening is only permitted with the express consent of the person concerned, section 81h(1) sentence 1 CCP. For the legal validity of this consent, a prior written instruction on the essential aspects of the concrete mass genetic test is necessary and the subsequent consent must also be given in writing.

The measure can only be ordered by the court, section 81h(2) CCP. Due to the clarity of the wording, there is no room for any deviation from this provision, e.g. in the sense of urgency powers or the consent of the parties concerned.[24]

According to the law as it stands, serial genetic screening results are not only envisaged to produce evidence to the effect that a sample directly matches the genetic reference material. In addition, genetic similarities of an examined person concerned with the available reference material ('near hits') can also be determined without sufficient agreement for classification as a potential offender, which allows for the creation of circumstantial evidence for further investigations against close relatives of the person concerned.[25]

Admissible results of the molecular and genetic analysis

In section 81e CCP, the legislator draws clear boundaries for the findings that may result from molecular and genetic screening by establishing a conclusive list of permitted examinations by law. DNA screenings are accordingly admissible for results and comparisons regarding the descent of the examined person. This applies to the material taken from the accused according to section 81a CCP, to materials taken from a third party pursuant to (section 81e(1) CCP) as well as to material found, secured or seized (section 81e(2), sentence 1 CCP). Screenings are also permitted to determine whether the material obtained stems from the accused or aggrieved party, or whether the person concerned can be excluded as the source of the traces. In addition, findings about gender are also admissible, provided that all findings are

22 R. Neuhaus, "StPO§ 81h", in: *Gesamtes Strafrecht*, D. Dölling, G. Duttge, S. König, D. Rössner (eds.), 4th edition, Baden-Baden, 2017, para. 3.

23 Judgment of the Regional Court (*LG*) Dortmund in: *Neue Zeitschrift für Strafrecht (NStZ)* 2008, 175, 176.

24 M. Goers, "§ 81h", in: *BeckOK StPO*, 39th edition, Munich 2021, para. 8.

25 Bundestags-Drucksache 18/11277, p. 21.

necessary in the sense of being relevant as evidence.[26] The amendment of the law at the end of 2019 introduced the additional findings listed in section 81e(2) sentence 2 CCP, namely the colour of eyes, hair and skin as well as the age of the person concerned if the identity of the person from whom the trace material stems are not known.[27] Since the application of these extended possibilities of determination requires the identity of the person from whom the trace material to be unknown, such findings are excluded not only if the examination material was taken from known persons, but also in cases where a comparison of the DNA identification profile with the analysis file kept at the Federal Criminal Police Office (*Bundeskriminalamt*) by virtue of section 81g(5) No. 2 CCP yielded a positive hit.[28]

Conversely, other or more extensive examinations for other personal characteristics are excluded, which is also expressly stipulated in section 81e(1) sentence 2 CCP. Any violations of this provision will result in a ban on the use of the resulting evidence.[29] Even if additional information about vulnerable personal characteristics is produced accidentally or unavoidably, this information may not be used in proceedings.[30] The absolute ban on the use of the information as evidence does not necessarily follow from the wording of the law, which could conceivably also be construed to include a case-by-case examination, in the course of which the individual interests must be balanced against the severity of the infringement of legal interests and the resulting need for criminal prosecution.[31] However, such an interpretation would probably not give sufficient effect to the legislative intention, namely to prevent inadmissible examinations.[32] These provisions are accompanied by the obligation incumbent on the expert to take personal responsibility for precautions against inadmissible investigations and for ensuring that no unauthorised third parties have access to information (para. (2) sentence 2). In consequence, the expert must categorically exclude inadmissible investigations, sections 81(2), sentence 2 CCP.

26 BeckRS 2020, 14004.

27 Bundestags-Drucksache 19/14747, 28; with a more critical approach regarding its practical importance: A. Gronke, K. Gronke, "Nutzen und Limitierungen der erweiterten DNA-Analyse im strafrechtlichen Ermittlungsverfahren", in: *Neue Zeitschrift für Strafrecht (NStZ)*, p. 141.

28 *Bundestags*-Document 19/14747, p. 26.

29 M. Goers, "§ 81e", in: *BeckOK StPO*, 39th edition, Munich 2021, para. 18.

30 *BT-Drs.* 13/667, p. 7.

31 A. Hadamitzky, "StPO§ 81e", in: *Karlsruher Kommentar zur Strafprozessordnung*, 8th edition, Munich 2019, para. 7.

32 M. Goers, "§ 81e", in: *BeckOKStPO*, 39th edition, Munich 2021, para. 5.

Restrictions on use, provision regarding the destruction

The examined material may be used only in the proceedings underlying the examination or any other, already pending criminal proceedings. Pursuant to section 81e, the material collected pursuant to sections 81a, 81c CCP may be stored only as long as required for the proceedings in question and must be destroyed afterwards. This provision on destruction, however, does not apply for the trace material within the meaning of section 81e(2), sentences 1 and 2 CCP.[33] Instead the rule applicable especially to open traces is that such material must not be destroyed given its irretrievability and in the light of the constantly evolving knowledge in molecular genetics.[34] DNA identification profiles obtained by examining the material stemming from the accused or from the trace material may be stored in the 'BKA analysis file' subject to the conditions stipulated in section 81g CCP in conjunction with section 8 of the German Federal Criminal Police Office Act (*Bundeskriminalamtsgesetz*).

Outlook: Possibility and limits by future provisions

It is still unclear when a DNA analysis would affect the inviolable core area of privacy protection in such a way that an intervention is no longer justifiable. According to the case-law of the German Federal Constitutional Court (*Bundesverfassungsgericht*), a DNA analysis must be classified as harmless in regard to fundamental rights as long as it concerns the examination of formal patterns of 'non-coding' sequences. Corresponding identification features to be determined in this connection should therefore not be assessed differently than fingerprints, blood characteristics or hair structure.[35] In addition, an analysis of the coding sequences containing information about the manifestation of a personality, hereditary diseases or character traits may be assumed to be likewise permitted. In the above-mentioned judgment of the Federal Constitutional Court, the question remained whether an analysis of the coding sequence would automatically lead to a violation of the general right of personality pursuant to Article 2(1) in conjunction with Article 1(1) of the German Basic Law remained unresolved. If such a classification were to be accepted, the question would then arise if this could also lead to restrictions on the examination of non-coding sequences in the cases when conclusions (couplings) can be drawn as to the coding sequences.[36] It should be noted in this regard that the legislature has refrained from

33 R. Neuhaus, "StPO§ 81e", in: *Gesamtes Strafrecht*, D. Dölling, G.Duttge, S. König, D. Rössner, 4th edition, Baden-Baden 2017, para. 4.

34 U. *Eisenberg*, "Beweisrecht der StPO", 10th edition, Munich 2017, para. 1686.

35 Judgment of the German Federal Constitutional Court in: *Neue Zeitschrift für Strafrecht (NStZ)* 1996, p. 46 et seqq.

36 U. Eisenberg, "Beweisrecht der stopp", 10th edition, Munich 2017, para. 1683a.

dividing the areas of DNA to be examined into coding and non-coding, while not ignoring the problem of possible mutual conclusions described above.[37] It should also be noted that a separation of coding from non-coding sequences is also not undisputed from a scientific perspective and is based on a merely preliminary hypothesis, which can be regarded as quite refutable and thus at least as not sacrosanct in the course of evolving scientific findings.[38] If this is the case, an intensification of the notion of separability of coding and non-coding sequences from the perspective of fundamental rights does not appear persuasive. Accordingly, limitations or restrictions in the area of the molecular genetic information to be examined should be drawn only on a case-by-case basis and with particular regard to the principle of proportionality.
From the perspective of the powers of the police, broader provisions for the collection and storage of DNA identification profiles would also be desirable. Among other things, it is proposed to follow the legal provisions applicable in the field of dactyloscopic fingerprints, thus creating the conditions for the use of information obtained in a kind of 'genetic profile', even in the case of less significant offences than before within the framework of section 81g CCP.[39] The proposal to replace the previous consent-based solution in the context of serial genetic screening in accordance with section 81h CCP with a compulsory model is based on a similar notion. Nor must the benefits, which are considerable in practice, obscure the view of the fundamental rights-related problems that are necessarily associated with them.[40]
The discussion also extends to the question of whether exceptions from the currently applicable, comprehensive requirement that only a judge may order the taking of cell tissue (requirement of a judicial decision, *Richtervorbehalt*) should be permitted to the effect that the public prosecution office or the police can also issue such orders under certain circumstances. Such initiatives would be quite useful in practice and also provide relief for the courts. However, both the German Federal Constitutional Court[41] and the European Court for Human Rights (ECHR)[42] require that protective statutory instruments prevent an excessive use of DNA analyses in criminal proceedings. While the requirement of a judicial decision as a supervisory level is not mandatory as such, it is nevertheless undisputed in terms of effectiveness and reliability. Any departure from such powers to issue injunctions must therefore be deemed to be quite critical.

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37 Bundestags-Drucksache 13/667, p. 6, 11.

38 M. Schneider, "DNA-Analyse und Strafverfahren de lege ferenda", in: *Neue Zeitschrift für Strafrecht (NStZ)* 2018, p. 694.

39 Ibidem, p. 695.

40 N. Bosch, *Neue Zeitschrift für Strafrecht (NStZ)* 2021, p. 41.

41 Judgment of the German Federal Constitutional Court, BVerfGE 103, p. 21, at p. 34.

42 "Ruling of the ECHR", in: *Europäische Grundrechte-Zeitschrift* (*EuGRZ*) 2009, p. 299, at p. 310 and p. 312.

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FORENSIC IDENTIFICATION

FORENSIC IDENTIFICATION ON THE BASIS OF AN EXPERT WITNESS'S OPINION FROM GENETIC TESTING

WOJCIECH ACHREM*

Introduction

One of the key notions used in forensic science is the term forensic identification. It was introduced as early as in the 19th century, when Alphonse Bertillon created the first system of defining the identity of persons suspected of committing a crime on the basis of anthropometric measurements.[1] The next stage in the process of personal identification was the development or rules relying on fingerprint properties. In 1892, a classification system was developed which, despite the lapse of a century, is still in use at present.[2] Expert witnesses in the field of dactyloscopic examinations assume that opinions allow to establish that trace evidence secured at a crime scene originates from the person from whom the reference material was collected provided that a concordant set of minutiae patterns has been ascertained and, simultaneously, no discrepancies have been recorded. Moreover, the topographic map of distinctive features must be identical between the questioned material and the reference one.
The development of analytical technologies used in forensic testing enables also to make the identification of a person based on an analysis of the physical characteristics of voice parameters and the linguistic parameters of speech. Comparing acoustic wave frequency parameters and language components it becomes possible to define which of the persons in question has uttered a given phrase. Individual, highly variable polymorphic traits of deoxyribonucleic acid, with the simultaneous process of enhancing genetic testing technologies applied in the criminal procedure, are

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1 J. Thorwald, *Stulecie detektywów*, Kraków 2009, p. 51.

2 J. Widacki (ed.), *Kryminalistyka*, Warszawa 1999, p. 3.

a source of information thanks to which it has become possible to define a person's identity.

The degree of technological development of test methods based on biometric traits (fingerprints, physical characteristics of the voice and linguistic ones of the speech, as well as genetic polymorphism) allows to perform forensic identification.

This article aims to present the process of individualization in biological testing, discuss the type of forensic identification in relation to the activity of a genetic testing expert witness, as well as illustrate theoretical aspects with conclusions from an expert witness's opinion.

The process of individualization. Types of identification in forensic genetic testing

The subject of these considerations are issues relating to genetic expert assessment, concluded with the giving of an opinion which, having fulfilled formal conditions, has the value of evidence. In this connection, it becomes necessary to apply a narrower definition of the notion of forensic identification, that does not go beyond the limits of an expert witness's actions.[3] In this context, the formulation is defined as the result of a testing process whose effect is an expert's ascertainment of the identity, or the lack thereof, with respect to persons, objects, traces.[4] In the expert witness's practice, it is generally assumed that identification consists in establishing material objects, on the basis of any traces and characteristics of the same, as left.[5] With reference to an expert biologist's procedural activity, this definition pertains to the process of examining items of trace evidence.[6] The final stage of the identification process is the establishment of the genetic characteristics of a person who has left a biological substance at a crime scene. During the preparation of an expert opinion, as soon as at the beginning of the testing procedure, it is often necessary to state what physical, chemical or immunological characteristics are of a sample to have been collected from biological trace evidence. Prior to taking up genetic tests, an expert defines whether the tested substance is blood, semen, epithelial cells, hair or tissue fragments. The identification of the kind of substance and the definition of its species affiliation is the stage which contributes to the reconstruction of the actual course of a crime.

3 Z. Czeczot, T. Tomaszewski, *Kryminalistyka ogólna*, Toruń 1996, p. 212.

4 Ibidem, p. 213.

5 For more details on the definition of the notion of forensic identification, its function and scope, cf. A. Szwarc, H. Kołecki, *Identyfikacja kryminalistyczna*, "Zeszyty Naukowe ASW", Vol. 1, Warszawa 1973.

6 M. Klejnowska, *Terminologia w nauce kryminalistyki – znaczenie i charakterystyka wybranych pojęć*, http://www.edukacjaprawnicza.pl/index.php?mod=m_aktualnosci&cid=69&id=956&p=4.

A characteristic feature accompanying the introduction of new analytical methods into forensic practice is the appearance of a number of interpretative issues. The history of forensic science shows that each new technology has aroused a lot of controversy. In relation to genetic testing, a number of objections and doubts were voiced in the eighties and nineties of the twentieth century,[7] which ended in the "DNA war." The introduction of this testing method into the Polish forensic practice involved controversy as well.

The notions, as well-established in forensic science, of "the same" and "the same kind of arrangement of polymorphic traits," are often misinterpreted both by expert witnesses and decision-makers, or even parties to criminal proceedings. Not infrequently, opinion conclusions feature an expression that the deoxyribonucleic acid profiles of the evidential and reference materials are identical. Such a statement is misleading for recipients of the opinion, because the genetic trait arrangement, even if it originates from one person, is never identical.[8] A DNA fragment tested by an expert witness is formed as a result of complex chemical and physical processes, whereas its analysis in a laboratory is based on comparing only selected, few trait arrangements. Their concordance does not mean sameness, but proves that the applied testing procedure does not allow to state the occurrence of natural differences. For these reasons, a genetic testing expert witness does not solve, in his/her opinion, the problem whether the DNA profile of the evidential and reference materials is a unique one or not. The comparison of the variable genetic trait arrangement leads only to the examination whether there is sufficient proof to state that the concordance of the tests results attests to a possibility that the biological material originates from one person, and is not solely a matter of chance. If the answer to the question so posed is the positive one, then it is assumed that the individual identification has been achieved on the basis of the analysis of genetic polymorphism. The analysis of DNA polymorphic traits fits well in the definition of forensics according to which it is a science of the process of individualization.[9]

In forensic terminology, referring to identification on the basis of genetic traits, the notion of "DNA fingerprinting" has been well established, which was to be a resolution to the dilemma whether genetic testing is as good for a result of the process of identification as dactyloscopic examinations. Setting the two research methodologies side by side is erroneous by definition. The inadequacy of the notion, as referred

7 A.M. Wasilewska, W. Achrem, *Prawno-kryminalistyczne aspekty analizy DNA – problem błędu w badaniach genetycznych. Rozprawy z Jałowcowej Góry*, Kraków 2004, pp. 163-175.

8 I.W. Evett, B.S. Weir, *Interpreting DNA evidence. Statistical Genetics for Forensic Scientists*, Sunderland 1998, p. 239.

9 Ibidem, pp. 240-241.

to, results from the existence of fundamental differences between these two identification methods.

In case of dactyloscopic examinations, analyses are conducted according to testing procedures meeting the requirement for general acceptance, however, identification conclusions are formulated by an expert on the basis of his/her subjective assessment. The expert witness notes the pattern details, analyzes the topographic arrangement of characteristic traits, checks for the existence of differences and compares these parameters to the reference material. Having defined a sufficient number of minutiae, the expert witness makes an identification judgement, relying on his/her own subjective perception which is not supported by statistical analysis.

In case of genetic testing, there is a clear trend for a constant increase of the number of polymorphic traits under examination. There were 10 polymorphic arrangements tested in the first multiplex PCR kits, whereas at present technologies are successfully applied in which 22 polymorphic arrangements are analyzed simultaneously.[10] By extrapolation, a result is obtained of such a value that a repetition of the variable genetic trait set in the population is practically impossible, since combinations of alleles in DNA become rarer and rarer. The identification of the origin of a sample does not, therefore, result from the expert witness's feeling of uniqueness, but its foundation rests on mathematical analysis based on population research. The notion of the probability of a repetition of a trait arrangement in the population is often incomprehensible for the adjudication panel and the parties to criminal proceedings. This leads to the misassumption that if an expert witness's opinion is not categorical, then there is a possibility of the occurrence of the same DNA profile in another, random, unrelated person from the population.[11]

Positive identification on the basis of dactyloscopic examinations means that the expert witness, relying on his/her knowledge and experience, has achieved a mental state demonstrating the certainty of the comparison of variable traits. There is no possibility for the court to verify this way of reasoning, whereas the role of the expert witness in this case is not to prove individuality, but to provide tools, in the form of an opinion, based on which the adjudicating panel will decide on the identity.

In the event of DNA profile concordance between the evidential material and the reference one, the judge or a representative of a process party, is able, by analyzing the tabular results in the opinion, to state that the genetic traits are concordant or are not identical. What is more, a genetic testing expert witness considers two alternative hypotheses: the concordance of the DNA profiles of the evidential material and the reference one means the origin from one person and a theory that the DNA,

10 ThermoFisher's Global Filer reagent kit user guide.

11 D.A. Stoney, *What made us ever think we could individualize using statistics?*, "Journal of Forensic Science", 1986, No 31, pp. 197-199.

despite the identity of the traits, originates from different persons. Verification of the assumptions with the use of mathematical tools, constitutes a basis while taking procedural decisions.

The notion of "DNA fingerprinting" played a positive role during the introduction of the scientific means of evidence into the practice of the judiciary. It is not, however, accurate to describe the method of personal identification on the basis of DNA polymorphic traits. Therefore, it should no longer be used in forensic science.[12]

Despite the fact that the methods of genetic analysis have established themselves well in the forensic practice, a particularly heated debate is incited by the method of classifying an expert witness's opinion conclusions into the group of personal identifiers. The reason for the dispute is the need to assess the uncertainty of test results. At the turn of the seventies and eighties of the previous century it was stated that the absolute identification certainty can be achieved when the value of the probability of a repetition of analyzed biological traits in another, random, unrelated person from the population being examined exceeds the value of 1:4,000,000.[13] In 1996, National Research Council announced a report in which it was stated that the Council members believe that the time would come when every person could be identified in forensic terms.[14] The declaration emphasizes that the essence of achieving the individual identification of a person by means of molecular biology methods is the examination of a sufficiently great number of polymorphic arrangements, as independent from one another. A dependence was described that the more such traits, the better for the reliability of an evidential opinion from genetic testing. A consequence of the report was the question about the lower limit of the probability parameter from which it can be assumed that forensic identification has been achieved.

The methodology of biological testing has been developing very dynamically in the last eight decades. This is a perfect example illustrating the phenomenon of individualization in modern forensics. The main goal of the process is consistent narrowing of the set of traits or persons (group identification) in a way that allows a few objects, or, in an extreme case, one object, to be included in a determined class of objects[15]. The decision-maker's assumption that this is the element sought after as necessary for the taking of a procedural decision, is based on probability calculus. The process of individualization began following the implementation of serological testing into the practice. At the first stage it was only possible to formulate the conclusion

12 I.W Evett, B.S Weir, *Interpreting DNA evidence…*, p. 240.

13 B.W. Grambaum, *Identyfikacja krwi ludzkiej i jej znaczenie dla postępowania karnego*, "Państwo i Prawo" 1979, No 1.

14 National Research Council. The evaluation of Forensic DNA Evidence. National Academy Press. Washington DC 1996.

15 Z. Czeczot, T. Tomaszewski, *Kryminalistyka ogólna…*, p. 215.

that the substance being secured is blood. Then experts performed tests based on which they stated that it was human blood. The next stage was to analyse blood types and compare those with the reference material. The introduction of enzyme systems, contained in the human liquid tissue, shifted the weight of expert witnesses' opinion in the direction of individual identification. By combining serological traits with ones based on enzymatic polymorphism could, in theory, result in achieving the value of probability of a repetition of given traits in the population amounting to 1:1.000.000[16]. It was stated that this probability value is sufficient for essential individualization of a biological trace. The same method of reasoning should be adopted in case of tests of deoxyribonucleic acid sequencing polymorphism. Simultaneous consideration of all results of DNA genetic fragments, located on autosomal, sex chromosomes or mitochondria, based on the law of independent event probability product, will allow to achieve individual identification, even if a separate analysis of individual results does not authorize drawing such a conclusion. The condition must be fulfilled of trait independence and exceedance of the limit value of the probability of a repetition of analyzed traits in the population, in unrelated persons.

The existing dilemma regarding the minimal value of mathematical parameters so that the statement is validated that individual identification has been achieved, should be resolved on the basis of population data. In the author's opinion, the parameter for the chance of a repetition of variable genetic traits in the population must assume a higher value than the estimated number of people who have populated the planet since the beginning of the species. This amounts to approximately 107,602,707,791.[17]

The adoption of such a limit in the process of identification results from the necessity to take into account a hypothetical relationship between the person who has left the biological material to have been secured during the inspection of the crime scene and the person from whom the reference material has been collected, which weakens the probative value thereof. Also, degradation processes or low DNA concentration, which bring about stochastic phenomena, e.g. allelic dropout, must be taken into consideration. If, nevertheless, the result of calculations of the probability regarding the hypothesis stating that the biological material originates from the person from whom the reference material has been collected, exceeds this limit, then the expert witness has the ground to state that he/she has achieved individual identification.

Considering the scientific character of a genetic testing expert witness's opinion, whose conclusions are a subject of mathematical discussion, there are grounds for conducting a synthetic analysis of terms, as already well-established in forensic science, and relating to the issues of personal identification. Its purpose is to assign

16 B.W. Grumbaum, *Identyfikacja krwi ludzkiej i jej znacznie dla postępowania karnego*…, loc. cit.

17 Data: Population Reference Bureau, www.prb.org.

relevant conclusions of a genetic testing expert witness's opinion to individual types of forensic identification. Thanks to such an interrelation, it will become possible to define the probative value of the expert's conclusion. The reference of commonly used terms to scientific proof will also enable process bodies and parties to the criminal procedure to verify ideas, often exaggerated, concerning the utility of an expert's opinion from genetic testing while taking procedural decisions.

Group identification in a genetic testing opinion

The notion of group identification refers to the examination and ascertainment of the affiliation of a questioned object to a certain set of objects. The purpose of the identification process is to state, in the course of laboratory examinations, that a specific trace has the same features as the reference material.[18]

In case of genetic testing based on polymorphic biological traits located on autosomal chromosomes, group identification will take place when the expert witness obtains an incomplete DNA profile which demonstrates concordance with the polymorphic trait arrangement of the reference material, and if the value of a repetition of such a polymorphic trait arrangement in another, random person in the population is lower than the number of people living on Earth. Calculations of the probability of alternative hypotheses are the basis for stating that there is a theoretical possibility of the occurrence of the same set of traits also in other persons. If this value amounts to, for instance, 10^6, this means that the theoretical possibility of a repetition of such an incomplete DNA profile in the population is 1 in 1,000,000 people. This means that in Poland there is, potentially, a group of 37 people who can have the same set of genetic traits.[19] The results of the statistical discussion of test results allow only for reference of the conclusion of an opinion to a specific group of people. The process of biological material individualization has been stopped at the stage of group identification.

It should be emphasized that such a situation will occur exclusively in case of concordance of an incomplete arrangement of traits of an evidential material with the DNA profile of the reference sample.

Below is presented an example of a genetic testing expert witness's opinion based on which group identification has been achieved:

> In the examined substance sample marked with the symbol 2345/6a (sample taken from the surface of a ballpoint pen – trace No 1), I have ascertained the presence of DNA of an incomplete profile. The arrangement of polymorphic traits is concordant

18 T. Hanausek, *Kryminalistyka. Zarys wykładu*, Kraków 2005, p. 47.

19 According to Statistics Poland data, the population of Poland in 2019 was 37.97 million.

> with the DNA profile of the person from whom the reference material has been collected. It is 8.3 x 10^5 times more probable to obtain a concordant result on the assumption if the biological material comes from the person from whom the reference material has been collected than to obtain such concordance if the biological material in the sample comes from another, random, unrelated person from the population. The value of the reliability quotient very strongly supports the assumption that the questioned biological material comes from the person from whom the reference material has been collected.

Despite the fact that the numerical value, as obtained, for testing alternative hypotheses, supports very strongly the assumption of the presence of biological material originating from the person from whom the reference material has been collected, still the value of the probability of the occurrence of such a polymorphic trait arrangement in the population has not exceeded the threshold number for individual identification. Therefore only group identification is possible.

In the process of demonstrating evidence for crimes of rape, it becomes necessary, beside the examination of a set of DNA polymorphic loci found in autosomal chromosomes, to perform an analysis of a haplotype of genetic arrangement variables, as located on the Y chromosome, found only in males. If, on the basis of the test results, the concordance is ascertained between the haplotypes of the evidential and reference materials, then there is a necessity to check how often the occurrence of such a test result has been reported in databases. On this ground, the incidence of a given trait arrangement is stated. Mean values of the probability of a repetition of the haplotype in the population are approximately ca. 10^{-7}, and this means that the statistical result classifies the opinion as group identification. Even if the value of the chance of a repetition of the trait arrangement in unrelated males decreases significantly in the future, in connection with the ongoing supplementation of the data base with new records, then, due to the heredity manner – only in the male line, without substantial recombination – test conclusions will still have the character of group identification (irrespective of mutational events). On the basis of genetic test results, it is often not possible to distinguish two related males from one another.

Below is presented an example of a genetic testing expert witness's opinion based on which group identification has been achieved.

> As a result of genetic testing of a substance sample marked with the symbol 2345/6a (sample taken from the surface of women's underwear – trace No 1),in the polymorphic genetic arrangements located on the Y chromosome, found only in males, I have assayed a haplotype concordant with the trait arrangement of the person whom the reference material has been collected. The incidence of a repetition of such a trait set in the European population amounts to 4.11 x 10^{-4}. It is 2433 times more probable to obtain a concordant result of the tested haplotypes on the assumption if the hypothesis is

true that the trace under examination comes from the man from whom the reference material has been collected (or his relative in the male line), than to obtain the same result, if the concordance to have been obtained is a matter of chance.

Individual identification in a genetic testing opinion

The achievement of individual identification is possible only when on the basis of unique individual features it may be ascertained that a specific object has left the trace under analysis.[20] In case of genetic testing, individual identification occurs only when there is concordance of polymorphic genetic traits (DNA profiles) located on autosomal chromosomes. The identity of deoxyribonucleic acid profiles means that, having performed the tests, occurrence of the same traits was ascertained in the biological evidential material and the reference material. The result of the genetic tests as recorded in the numerical form is irrelevant for the process of forensic identification if it has not been discussed in statistical terms. The crucial point of the mathematical analysis is defining the chance of a given biological trait arrangement to repeat itself in the group of people living in the region. The structure of the expert witness's opinion contains the necessary element of uncertainty, as assessed. This is the main reason which results in a genetic testing expert witness's conclusions do not have the characteristic of categoricalness. In case of a statistical analysis of several dozed polymorphic traits that are passed down from generation to generation in a way as independent of each other and of the individual's sex, the number of possible combinations is so great that the law of large numbers applies.[21] On its basis it is allowed to use the extended notion of probability. In case the numerical values of a calculated chance of the occurrence of the same traits in other persons vary slightly from one (that is the upper extreme, that mathematical probability may take), and the chance that another result is possible approaches zero, then it is allowed to use the expression "empirical certainty,"[22] or "practical certainty."[23] In forensic practice, the above-described assumptions are fulfilled when: the quality of biological material is within the optimal range (appropriate concentration of DNA and a minimal level of degradation of the same) and the concordance of DNA profiles has occurred

20 Z. Czeczot, T. Tomaszewski, *Kryminalistyka ogólna…*, p. 215.

21 Statistical calculation issues for the purposes of the judiciary have been analyzed by L.J. Cohen, "The logic of Proof', *The Criminal Law Review* 1980, and by C. Ritzer in: *Police Mathematics. A textbook in applied mathematics for police,* 1955.

22 Z. Czeczot, T. Tomaszewski, *Kryminalistyka ogólna…* , p. 219.

23 This notion is applicable for statistical inference, when, with the existence of many variables, a generalizing theorem is created based on the knowledge of a sample, discussed more Z. Rogoziński, *Metody statystyczne w prawoznawstwie*, Warszawa 1976, p. 193.

(of loci on autosomal chromosomes) of the reference and evidential materials. The chance that the deoxyribonucleic acid fragments, as analyzed, of the same profile may originate from two different, random unrelated persons from the population maximally approaches zero, whereas the probability that it is the biological material left at the crime scene by the person from whom the reference material has been collected is very close to one. The above-presented theorem is true exclusively if there is no kinship. In case family ties occur, the first *conditio sine qua non* is not kept, because of a considerable decrease in the probability of the origin of the biological material from the suspect (the accused) and not from a person related to him/her, due to the hereditary characteristics of polymorphic traits. Hence the chance parameter departs from one.

With the exception of these two cases, it may be stated that genetic testing expert witness's conclusions, in a situation of the concordance of DNA profiles, classify this means of evidence as individually identifying the person who left his/her biological material at the crime scene. Yet, the necessity to apply a statistical discussion deprives the expert's opinion of the value of categoricalness.

Below is presented an example of an expert witness's opinion based on which individual identification has been achieved:

> In the examined substance sample marked with the symbol 2456/8a (sample taken from the surface of a glass – trace No 2), I have ascertained the presence of DNA of male profile as concordant with the DNA allele arrangement of the person from whom the reference material has been collected. The probability of a repetition of such a DNA profile in a random, unrelated person from the population amounts to 1.3×10^{-21}. It is 7.69×10^{20} times more probable to obtain a concordant result of the tests on the assumption if the hypothesis is true that the trace under examination comes from the person from whom the reference material has been collected than to obtain the same result, if the concordance to have been obtained is only a matter of chance. The value of the reliability quotient extremely supports the assumption that the biological material comes from the person from whom the reference material has been collected.

The value of the probability of the occurrence of such a polymorphic trait arrangement in the population in another, random, unrelated person has definitely exceeded the threshold number, and therefore individual identification is legitimate. What is important, the expert has not ascertained, either, that there are differences in the polymorphic trait arrangement between the evidential and reference materials.

Forensic practice shows that it is often necessary to answer the question whether biological traces left at different crime scenes (distanced from each other by time and location) originate from the same person. If resulting from a comparison of DNA profiles of forensic traces, an expert witness states that there occurs the same polymorphic trait arrangement, then it becomes necessary to hold a statistical discussion

of the results. The value of the hypothesis that the same trait arrangement comes from the same person is close to one. At the same time, the probability that biological forensic traces (of concordant DNA polymorphic trait arrangement) might have been left by two unrelated persons approaches zero. The simultaneous fulfilment of these two conditions authorizes the assumption that the hypothesis that the forensic traces which have been secured during the inspection of various crime scenes originate from one person is more probable than they come from different, random, unrelated persons from the population. It is important to verify the thesis whether the accused has a closely related person, not excluded from the circle of suspected persons.

An expert witness's identification of the origin of a great number of traces from one person is a relevant piece of information, frequently used by law enforcement agencies. The opinion's conclusions allow to link the suspect to a number of other crimes to have been committed earlier.

Below is presented an example of an expert witness's opinion based on which individual identification has been achieved relying on DNA profiles of forensic traces:

> In the examined substance sample marked with the symbols: 2456/8a (the tests were performed during the preparation of an expert opinion for the preparatory proceedings RSD 234/10 KP in Trzebiatów), 5678/1 (the tests were performed during the preparation of an expert opinion for the preparatory proceedings RSD 23897/10 KMP in Szczecin), 10234/15c (the tests were performed during the preparation of an expert opinion for the preparatory proceedings RSD 10000/10 KMP in Świnoujście), I have ascertained the presence of DNA of the same male polymorphic trait arrangement. The probability of a repetition of such a DNA profile in a random, unrelated person from the population amounts to 1.3×10^{-20}. It is 7.69×10^{19} times more probable to obtain a concordant result of the genetic tests on the assumption if the hypothesis is true that the traces under examination come from one person than to obtain the same result, if the concordance to have been established is only a matter of chance. The value of the reliability quotient extremely supports the assumption that the biological material comes from one person.

The parameter of the probability of the occurrence of such a polymorphic trait arrangement in the population in another, random, unrelated person has definitely exceeded the threshold number, and therefore individual identification is legitimate. The expert has not ascertained, either, that there are differences in the polymorphic trait arrangement between the evidential materials as collected during the preparation of an expert opinions to have been ordered for various criminal proceedings.

The so-called negative identification in a genetic testing opinion

Negative identification is the statement that the traits of an object under examination, as compared to each other, do not demonstrate mutual concordance. The lack thereof results in the exclusion of the origin from one source (person or object).
Distinctive traits in genetic testing opinions are alleles, recorded in a numerical form, which create a DNA profile. If, having performed laboratory tests from the sample of a biological substance collected from an evidential material, a result has been obtained that is not concordant with the deoxyribonucleic acid polymorphic trait arrangement of the reference material, then the presumption appears that the biological material to have been secured in the course of a procedural act does not originate from the person from whom the reference material has been collected. Due to the occurrence of the natural phenomenon of DNA mutagenesis, as well possible errors during the amplification process, the analysis is essential of the quality and number of differences between the deoxyribonucleic acid profiles of the evidential and reference materials. If the *conditio sine qua non* is fulfilled of the minimal discriminatory number (excluding the phenomena as referred to above), then the expert witness obtains rational grounds for classifying the genetic testing results as providing negative identification.
A doubt arises whether on the basis of genetic testing results it is possible to categorically exclude a person as the donor of the biological material that has been secured during the procedural act?
An essential element in the definition of negative identification (in case of DNA profile testing) is trait discrepancy between the evidential and reference materials. Exclusive inference has a categorical, therefore certain, character. This means that an expert witness must have at his/her disposal adequate analytical tools that allow the discovery and diagnosis of all existing differences. In case of forensic genetic testing this condition is not fulfilled.
The scope of genetic testing can be illustrated by the example of the forest and the torch. A person using a torch in the dark can see just a small fragment of the stand, limited by the light beam. If only beech trees are within the reach of the light, can one state categorically that there are no oaks growing in the forest? The negative statement would only be based on a subjective extrapolation of what has been exposed and examined. Such a situation takes place in forensic genetic testing. Expert witnesses examine only several dozen variable genetic arrangements, which comprises a tiny percentage of the entire genome. Thus, a significantly larger part of the organism's DNA stays "in the dark". In case of a scientific means of evidence, every theorem must have a rational foundation and it is not possible to reach the level of absolute certainty on the basis of an examination of a small fragment of reality. The method of lighting the forest with a torch is imprecise, has its specific selectivity and

sensitivity. This leads to a situation when young oak trees that are at the outset of their growth will not be noticed by the observer. This means that they have not been discovered, not that they do not exist in the forest. Genetic testing methods, as applied in forensic science, are characterized by a defined sensitivity. As a result of the technological development of testing methods, their capability of obtaining results from a smaller DNA concentration and selectivity has been constantly increasing. Currently, it is possible to assay a DNA profile from as few as a dozen or so cells. That which cannot be detected at present will be diagnosable in the future. Moreover, every testing method is characterized by an assessed level of imperfection. Gaining absolute certainty as to the lack of presence of biological material is therefore impossible. This is confirmed by forensic practice, particularly in resumed criminal proceedings of the so-called X-files, as well as in the case of criminal proceedings regarding crimes of rape.

The genetic testing methodology a decade ago differed considerably from the ones performed at present. This pertains not only to analytical procedures, but also to the inference method. Performing tests at the turn of the centuries, expert witnesses used reagent kits and devices enabling DNA profile assay within the concentration range from 0.1 to 1.25 ng/µl. A result was obtained of a polymorphic trait arrangement originating from one person, e.g. a male, of a profile as discordant with the polymorphic trait arrangement of the person from whom the reference material had been collected. On the basis of the test results, the expert witness stated that the suspect is not the donor of the biological material to the secured trace (categorical exclusion). Years later, genetic testing of the biological material was ordered again. Having performed the tests, with the use of state-of-the-art reagents and laboratory equipment (method sensitivity from 0.02 ng/µl), it turned out that in the sample there is a DNA mixture coming from at least two persons. The DNA profiles were assayed, as follows:

- the dominating one, concordant with that which had been established during the first test,
- a minority component concordant with the DNA profile of the suspect.[24]

As a result of a statistical analysis of the test results (based on alternative hypothesis testing), it turned out that the value of the reliability quotient extremely strongly supports the assumption of the presence of the biological material coming, among others, from the suspect. Thus, the previous exclusion was invalid, which misled the process bodies.

Another example that disables categorical negative inference is genetic testing results in expert opinions ordered for criminal proceedings in rape cases. In case of

24 A case from the author's professional practice as a genetic testing expert witness.

a biological material taken from the injured party's body, the amount of the biological material originating from the female is considerably larger than the one coming from the male. As practice shows, component relations are bigger than 1 to 10, which often renders it impossible to diagnose the DNA profile of the minority component in mixtures. As a consequence, performing genetic tests with reagent kits in which, beside polymorphic trait arrangements, there are also markers located on the Y chromosome (found only in males), the expert witness obtains only the female's DNA profile. Both in the amelogenin locus and the polymorphic arrangements of indels or DYS there is no signal that would attest to the presence of a male DNA.[25] The witness expert, on the basis of the results, excluded the presence of the biological material originating from the male. Performing genetic tests with reagent kits that amplify the male's DNA fragments, a DNA haplotype was obtained. It means that in the sample there is after all a male DNA based on which positive group identification of the biological material donor will be possible. The example shows that the exclusion was invalid.

Advocates of the view that discordance of the DNA profiles of the evidential and reference materials is sufficient for categorical negative inference, maintain an expert witness's identification decision relies exclusively on the results of analyses, as obtained, and one may not consider traits that cannot be recovered at present. The consequence of such an attitude is elimination of areas of the uncertainty of scientific evidence, especially measurement and explanation uncertainty.[26] Not estimating the value of these parameters makes an expert witness's opinion lose the value of scientificity. Attention should also be paid to the semantic layer of a conclusion. A categorical statement is understood by recipients in such a way that the expert has gained certainty that the biological material does not come from the person from whom the reference material has been collected. A conclusion of such wording misleads process decision-makers and may be a reason for taking wrong decisions.

Relying on the above considerations, below is presented an expert witness's conclusion based on which the so-called negative identification may be achieved:

> In the examined substance sample marked with the symbol 2345/6a, I have ascertained the presence of a male DNA of a profile as discordant with the trait arrangement of the person from whom the reference material has been collected. I have not ascertained the presence of his biological material in the examined substance sample.

In case an incomplete profile and DNA mixtures are obtained, the level of uncertainty increases, which results from the appearance of stochastic phenomena and the number of allelic combinations forming DNA profiles. Hence, an expert witness,

25 A case from the author's professional practice as a genetic testing expert witness.

26 J. Konieczny, *Identyfikacja kryminalistyczna*, Warszawa 2017, p. 120.

while formulating the opinion's conclusion, must provide for an increased margin of uncertainty. Therefore, the wording of the conclusion is different:

> In the examined substance sample marked with the symbol 2345/6a, I have ascertained the presence of a male DNA of an incomplete profile as discordant with the trait arrangement of the person from whom the reference material has been collected. I have no basis for stating that his biological material is found in the examined substance sample.
>
> In the examined substance sample marked with the symbol 2345/6b, I have ascertained the presence of a DNA mixture coming from at least two persons. On the basis of a qualitative analysis of the test result and mathematical calculations, I have no basis for stating that the biological material coming from the person from whom the reference material has been collected is found in the sample.

This kind of expert witnesses' opinions is clearly underestimated. The problem resulting from forensic practice is also raised in the literature on the subject.[27] Process decision-makers attach less importance to a scientific means of evidence that provides negative identification in comparison to an opinion whose conclusion allows to classify the same as identifying individually. A high practical value is neglected of expert opinions eliminating the guilt of a perpetrator in the process of demonstrating evidence. Having ascertained the discordance of the DNA profiles of the suspected or accused person with the results obtained from samples collected from the evidential material, all attention, as well as procedural and operational activity of law enforcement agencies, is directed to searching for the actual perpetrator of the crime, as committed. The negative genetic identification is of great importance while reconstructing the progress of committing the crime. Comparing DNA profiles of forensic traces that have been secured in the course of a procedural act – the inspection of various crime scenes where the perpetrators' *modus operandi* was similar – will allow to draw an identification conclusion. The lack of concordance of traits in DNA profiles shows that there is a good chance that the biological material may come from a number of persons. It is a relevant clue for the process body determining further decisions to be taken, on the assumption that the evidential material originates from actual perpetrators of crimes.

Relying on the above considerations, below is presented an expert witness's conclusion based on which negative identification may be achieved:

> In the examined substance sample marked with the symbol 2345/6a, I have ascertained the presence of a male DNA of a profile as discordant with the DNA polymorphic

27 Z. Czeczot, T. Tomaszewski, *Kryminalistyka ogólna…*, p. 217.

trait arrangement to have been assayed for the sample 2345/7a. This means that I have no basis for stating that the DNA under analysis comes from the person who has left the biological substance in the sample marked with the symbol 2345/7a.

Forensic individual identification resulting from group identifications in biological testing

In forensic biological testing, the expert witness must consider whether on the basis of the results of a few group identification tests, relying on different methodological foundations and diagnosing various identification traits, it is possible to draw a conclusion of an individual character.

Genetic testing is characterized by the need to perform a statistical analysis of the result obtained. Providing the expert has at his/her disposal a biological material whose degree of degradation is not significant, then usually a complete DNA profile is obtained in the course of effecting the expert opinion. In practice, expert witnesses deal with a different situation in which, having performed tests of the DNA located on autosomal chromosomes, it becomes possible to assay an incomplete set of polymorphic traits. A statistical discussion, as held, shows that on the basis of the result of laboratory examinations it will be possible only to achieve group identification. If the expert implements another testing procedure, relying on other assumptions (e.g. polymorphism of genetic arrangements located on the Y sex chromosome, found only in males) and obtains concordant DNA haplotypes of the evidential and reference materials, then he/she receives a second, independent result based on which there will also be a possibility to achieve group identification.

It is also possible to perform tests of genetic polymorphism located on the X sex chromosome. If the expert witness obtains concordance of DNA profiles, then he/she has a basis to draw a group identification conclusion.

In the course of laboratory examinations, a number of results has thus been obtained confirming the sameness of the evidential and reference materials. Testing methods have been applied that use distinct DNA sequence fragments (located on other chromosomes). A separate mathematical discussion of the results shows that the calculated values of the probability of a repetition of analyzed polymorphic traits in the population allow only achieving group identification. If a genetic testing expert witness juxtaposes all test results against each other, on the assumption that they support only one of the hypotheses, then, is information so obtained sufficient to assume that it is possible to achieve individual identification?

This problem has been analyzed in the literature relating to forensic genetic testing[28]. If results of genetic tests based on the analysis of various deoxyribonucleic acid

28 J. Buckelton., Ch.M. Trigss, et al., *Forensic DNA evidence…*, Chapter 9.3.6.

fragments are concordant, this means that the suspect's DNA cannot be eliminated on the basis of any of them. It is possible to juxtapose the results to have been obtained. The expert tests the probability of alternative hypotheses: the one favouring the prosecution's position as well as the one in favour of the position of the defence. The theorems being analyzed have been composed of all partial results, that is the genotypes of autosomal loci, the Y haplotype, the X DNA profile of the suspect and the sample collected from the forensic trace as secured at the crime scene. Having gathered all the data, the prosecutor's hypothesis will read that the observed concordances in the DNA polymorphic trait arrangement, in the autosomal loci and the ones located on sex chromosomes, in comparison with the same traits of the sample collected from the suspect, authorize a claim that the hypothesis that it is the DNA originating from him/her is more probable than an alternative assumption. The defence side will attempt to prove that the sameness of the results of the genetic analyses of the evidential and reference materials do not signify the origin from one person.[29]

Taking into consideration the formal foundations, the laws of population genetics and the rules of statistical analysis, nothing stands in the way for such an approach to the issue of identification on the basis of methods analyzing genetic polymorphism. Results thus obtained significantly shift the expert's conclusions in the direction of individual identification. The possibility to achieve individual identification based on all test results depends on partifal results obtained of the probability of a repetition of a given arrangement of variable traits in the population. The higher the value of the product of partial probabilities, the more the expert witness's reasoning, as contained in the opinion's conclusion, shifts in the direction of individual identification. Does this, however, mean that these results are a sufficient basis for achieving personal identification? In order to answer this essential problem, a chance should be considered of the occurrence in the population of a person (unrelated and related) who would be characterized by the same set of polymorphic traits. Such an approach, correct in terms of the rules of logic, is also necessary with respect to the law of large numbers which, as mentioned in an earlier part of this study, applies to the mathematical interpretation of genetic testing results.

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29 Ibidem, Chapter 9.3.6.

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THE QUALITY OF FORENSIC SCIENCE

MANAGEMENT SYSTEMS IN COURT LABORATORIES

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The purpose of this chapter is to provide the characteristics of the requirements which must be met by court laboratories in order to obtain the certificate of accreditation of the Polish Centre for Accreditation (PCA) for compliance with the standard PN-ENISO/IEC 17025, and then the maintenance of an implemented management system and improvement of the same. The above activities aim to ensure the highest quality of opinions prepared by expert witnesses for law enforcement agencies and judicial authorities.

Introduction

Since the half of the 20th century, we have observed an ongoing process of globalization in which an important element is not only the commercial and technical exchange, but also the flow of people and information. It is worth emphasizing that the above phenomena are accompanied by negative social phenomena, including an increase in cross-border crime. Due to the above, international cooperation of law enforcement agencies and judicial authorities tightens as well. One of the areas of this cooperation is the standardization of the so-called forensic process. This pertains, first of all, to all actions, as taken, from recovering and securing a forensic trace at the incident scene, up to the preparation of an expert witness's opinion. The next step is the standardization of the procedures, from the moment of the initiation of proceedings to the conclusion of the proceedings at the court stage. This will allow for the recognition of respective stages of these proceedings by all member states in whose territories criminal activities have been undertaken.[1] In connection with

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1 A. Dębski, A. Łukomska, *Postępy w normalizacji badań kryminalistycznych w Europie*, "Problemy Kryminalistyki" 2013, Vol. 279 (1), pp. 68-70.

the above, the key importance is attached to ensuring the highest quality of forensic services provided, by expert witnesses possessing the highest qualifications and competencies.[2]

Legal regulations and recommendations regarding accreditation

Accreditation (French: *accréditer* – empower) is an official confirmation of a laboratory's competence to perform tests, recognition of reliability, impartiality and independence of operation.[3] It also proves that a management system has been established, implemented and maintained, as appropriate for the scope of its activity. The accreditation system functions on the basis of legal norms, is independent and impartial, and as such is not subject to the rules of competition (there is only one accreditation body in every country). What is very important, accreditation is voluntary, whereas the condition to have the same is the customer's requirement. Such a specific customer is the regulatory body and in a situation when having accreditation in a given field is a legal requirement, we refer to a regulated area. Of course, such regulation does not mean that a laboratory cannot perform tests if it is not accredited. However, the application of tests results to activities defined in a legal regulation may take place when these have been performed in a laboratory whose scope of accreditation includes these tests. Rules of accreditation are specified by international norms and guidelines, establishing requirements both for accreditation bodies and for units (laboratories) which are subject to accreditation. The obtainment of a certificate of accreditation proves that the accredited laboratory has been assessed according to these norms and guidelines. Accreditation is granted by accreditation bodies and confirmed by a certificate of accreditation which also defines the scope of tests covered by the accreditation. The national accreditation body in Poland, being a state legal entity, is the Polish Centre for Accreditation (PCA), which is supervised by the minister competent for economic affairs.[4] The accreditation bodies in the EU countries have established an organization of national accreditation bodies (the European co-operation for Accreditation – EA). The EA Multilateral Agreement (EA-MLA) ensures that the competencies of all laboratories are assessed according to the same principles, and certificates and reports issued by organizations accredited by the EA members are equally reliable. It should be emphasized here that Regulation (EC) No 765/2008 of the European Parliament and of the Council of 9 July 2008, setting out

2 M. Skorecki, *Proces harmonizacji standardów opiniowania biegłych sądowych w Polsce i Unii Europejskiej*, "Przegląd Policyjny" 2008, Vol. 3 (91), p. 229.

3 PN EN ISO/IEC 17000:2006, Conformity assessment – Vocabulary and general principles.

4 The Act of 30 August 2002 on the conformity assessment system (Journal of Laws of 2002, No 166, Item 1368 as amended).

the requirements for accreditation and market surveillance relating to the marketing of products and repealing Regulation (EEC) No 339/93, regulated in an unambiguous manner the place and role of the EA regarding accreditation and application of the same in the EU.[5]

As regards court laboratories, accreditation is granted for compliance with the standard PN-ENISO/IEC 17025.[6] The fulfilment by a laboratory of the requirements of the standards means that the laboratory has technical competencies and a management system as necessary for ensuring reliable results of the testing. It should be emphasized that accreditation is a process that may function only on the basis of the personnel's engagement and the provision of adequate means and resources. Based on this standard, a number of documents have been created that pertain to laboratories performing tests for the needs of law enforcement agencies and judicial authorities. An important document is a court laboratory manual developed by the International Laboratory Accreditation Cooperation (ILAC), an organization whose member is PCA as well.[7] On the other hand, the *European Network of Forensic Science Institutes* (ENFSI) have constituted a special committee called QCC (the Quality and Competence Committee),which deals with issues of the quality management system. Interpol has released guidelines on DNA data exchange in which it is stated, among others: "(…) in order to optimize the advantages of applying DNA profiling results, global profiling standards and quality assurance issues should be defined (…)."[8]

According to Council framework Decision 2009/905/JHA of 30 November 2009, forensic service providers carrying out laboratory activities are obligated to obtain accreditation. This decision aims to ensure that the results of laboratory test carried out by accredited forensic service providers in one Member State are recognized by law enforcement agencies and judicial authorities in another UE country. Such an approach results from the need to establish common standards for forensic service providers within the area of the European Union. The legislators provided that accreditation gives necessary guarantees that laboratory activities are carried out in accordance with applicable international standards, in particular EN ISO/IEC 17025. It should be underlined that the addressee of the abovementioned Decision is every entity, both private and public, carrying out forensic laboratory activities (genetic

5 Regulation (EC) No 765/2008 of the European Parliament and of the Council of 9 July 2008 setting out the requirements for accreditation and market surveillance relating to the marketing of products and repealing Regulation (EEC) No 339/93. OJEU L 218 of 13.08.2008.

6 PN-EN ISO/IEC 17025:2018 – General requirements for the competence of testing and calibration laboratories.

7 ILAC-G19:08/2014, Guidelines for Forensic Science Laboratories, International Laboratory Accreditation Cooperation.

8 Interpol Handbook on DNA Data Exchange and practice. Recommendations from the Interpol DNA Monitoring Expert Group. Second Edition, 2009.

and dactyloscopic examinations) at the request of a competent law enforcement agency or a competent judicial authority.

The legislators have defined a laboratory activity as every action undertaken in a laboratory related to the recovery and securing traces on objects, testing, analysis and interpretation for the purpose of preparation of an opinion by an expert witness. It should be underlined that all activities carried out outside the laboratory are not the subject of the abovementioned regulation, this regards, for instance, the inspection of the incident scene.

Taking into account the need to adapt to the new regulations, the following effective dates for the decision were introduced: for genetic laboratories – 30 November 2013, and for laboratories performing dactyloscopic examinations – 30 November 2015.[9]

On 14 December 2011, another document of the Council of the European Union was released devoted to the planned establishment of the European Forensic Science Area and the development of forensic infrastructure in Europe. According to this plan, by 2020 the European Forensic Science Area will have been achieved in which one of the key elements will be accreditation of forensic science institutes and laboratories.[10]

This document drew attention, among others, to the observance of minimal criteria for testing personnel's competence, development of common best practice manuals and application of the same in the everyday work of forensic science laboratories and institutes, carrying out international laboratory proficiency tests. These and other activities aim to recognize the equivalence of forensic activities of law enforcement agencies in various EU countries in order to significantly shorten the time needed for the conclusion of cases regarding cross-border crimes. This pertains, in particular, to terrorist attacks and organized crime. The document also points to defining optimal and joint methods of creating, updating and making use of forensic databases, taking advantage of the progress in forensic sciences in combating terrorism, organized crime and other criminal activity. An important place is also occupied by the training process for law enforcement agencies and judicial authorities, as well as research and development projects aiming to support the further development of forensic science infrastructure.

An important stage of the standardization of testing in the area of forensic science was the foundation of the CEN/TC 419 ISO/TC 272 Project Committee "Forensic Process" within the framework of the European Committee for Standardization. The purpose of the Committee is to develop a European standard system providing

9 Council framework Decision 2009/905/JHA of 30 November 2009 on Accreditation of forensic service providers carrying out laboratory activities, The Official Journal of the European Union 2009, L.322/14-16.

10 Council conclusions on the vision for European Forensic Science 2020 including the creation of a European Forensic Science Area and the development of forensic science infrastructure in Europe.

for the integrity of forensic procedures at all stages of proceedings (inspection of the incident scene, recovery, securing, transport and storage of evidentiary material, laboratory testing, interpretation of results and test reporting. This is also expected to facilitate information exchange between the legal systems of different countries. Representatives of national standardization organizations from 23 countries take part in the works of this committee. Representatives of national standardization organizations from another 19 countries are granted observer status. The equivalent of this committee in Poland is the Task Committee for Forensic Procedures founded on 14 March 2014, acting within the Polish Committee for Standardization. The purpose of the Committee is to develop procedures, guidelines, and analyses concerning the forensic process, in particular including recovery of forensic traces, laboratory testing, giving opinions, as well as collecting and processing forensic information.[11]

Recommendations of the *European Network of Forensic Science Institutes* (ENFSI)

The *European Network of Forensic Science Institutes* (ENFSI) was established in 1995 for the purpose of enhancing the mutual exchange of information in the field of forensic sciences between member states' laboratories. One of the key goals of this organization is to improve the quality of forensic services in the countries of the European Union. On 12 May 2016, ENFSI published the document entitled "Policy on Standards for Accreditation," in which the importance was emphasized of reliable and coherent scientific evidence at every stage of the procedure, from actions at the scene of a criminal incident to court proceedings. The document underlines the need for forensic laboratories to obtain the certificate of accreditation according to the standard ISO/IEC 17025. Another document was published on 30 May 2019 under the title "Policy on Accreditation," which points at the need to promote coherent and reliable scientific evidence at every stage of the procedure in criminal cases. ENFSI members' laboratories should strive not only to maintain the current scope of accreditation, but they should also aim at increasing the scope of accreditation so that it includes all disciplines of knowledge represented by ENFSI's Expert Working Groups. Only those areas of knowledge should be taken into account in which an average of at least twelve tests a year are performed.

11 https://pzn.pkn.pl/tc/#/information-sheet/9008957566 (access June 16 2021).

Scope of accreditation according to the standard PN EN ISO/IEC 17025

In the process of accreditation, only those areas of the laboratory's activity are subject to assessment which are included in the application addressed to the PCA. With respect to the applicant's other areas of activity, these are assessed to such an extent as to make sure that they do not have an adverse effect on the satisfaction of the accreditation requirements.[12] It should be noted that a laboratory is to define precisely the scope of its activity, taking account of the field of testing, as well as the methods and procedures being applied. The assessment of the scope of accreditation constitutes the main element of the accreditation process and it may be defined as a set of actions carried out by the accreditation body in order to ensure, with an adequate degree of trust, that the laboratory has competencies to execute reliable services within a specified scope.[13] The result of the assessment carried out by the accreditation body is the definition of the scope of the laboratory's competencies to perform tests. This scope comprises a specification of test methods in the form of the scope of accreditation, and so formulated – constitutes the permanent scope of accreditation. This means that the laboratory must not modify the methods covered by the scope if it wants to rely on the accreditation as granted.[14] Due to the fact that such an approach did not always enable effective review of agreements with customers, the PCA has introduced, since 2009, a possibility to obtain accreditation in flexible scopes. This means that in the areas of activity, as defined in a flexible scope, the laboratory is able to react to the needs of its customers by modifying or including additional methods into its scope of accreditation without having to inform the PCA every time, provided that these methods do not introduce new measuring techniques, not covered by the originally described scope of accreditation.[15]

The components of an assessment always are: a review of the documentation, an onsite assessment carried out at the laboratory premises and observations of services provided under real conditions. The review of the laboratory's documentation comprises the following elements:

1. The Quality Policy which describes the strategy of the laboratory regarding its operation, development and management system enhancement. It contains declarations of the management as regards the application of requirements standards', a continual improvement process, assignment of resources as necessary for system

12 I. Sołtyszewski, A. Wójtowicz, *Wybrane aspekty akredytacji laboratoriów badawczych*, "Problemy Kryminalistyki" 2002, Vol. 236, pp. 14-17.

13 ILAC-G18:04/2010, Guidelines on formulating scopes of accreditation for laboratories.

14 J. Wierzchowiecka, *Rozwój usług laboratorium z elastycznym zakresem akredytacji*, "Zeszyty Naukowe Uniwersytetu Szczecińskiego Vol. 694, Problemy Zarządzania, Finansów i Marketingu" 2011, Vol. 22.

15 DA-10 Accreditation in flexible scopes, PCA, Issue 2 of 25.05.2020.

development, identification and satisfaction of customers' needs and expectations and quality goals as set within the management system.
2. The Quality Manual and general procedures present the principles of the functional management system, responsibility and methods of operation. It is a kind of a guide of the management system in which there is, among others, the declaration of the Quality Policy, the organizational structure of the laboratory, the scope of responsibility and authority assigned to the personnel, general methods and procedures for quality assurance, corrective actions in case of detection of irregularities in tests.
3. Procedures regarding technical activity, applicable in the laboratory, communication, methods of preparation of samples for testing, completion of test documentation.
4. Technical instructions containing a detailed code of practice.
5. Records in confirmation of the fulfilment of the requirements.

The onsite assessment includes a collection of evidence by the assessment team and consists in asking questions, having conversations with the personnel, analyzing documents and records and observing practical activities within the area comprised by the scope of the assessment. During such observation, the laboratory should also present objective evidence in confirmation of its technical competencies in this area. It should be emphasized that a prerequisite for granting accreditation by the PCA is the assessment team's obtaining assessment evidence supporting sufficient trust in the laboratory's competencies in the scope of application for the accreditation or in the scope of the accreditation as held (this regards supervisory assessment), followed by a positive recommendation of the assessment team confirming that the applicant laboratory meets all accreditation requirements, including the requirements under PN-EN ISO/IEC 17025.[16]

Selected aspects of the management system

The requirements of the standard PN-EN ISO/IEC 17025 are universal and refer to every laboratory, irrespective of its size, methods used for testing and structure, i.e. whether the laboratory is an independent entity or whether it is a part of a larger structure, e.g. a higher education institution. A laboratory should apply test methods that guarantee the fulfilment of the customer's requirements. In connection with the above, test methods and procedures should be documented, providing the source of their origin (manuals, guidelines, standards, validated own methods, literature). Laboratories may also apply their own test methods if they are suitable for the intended

16 DA-07 Accreditation of test laboratories, PCA, Issue 11 of 24.01.2019.

application and have been validated priorly. Moreover, laboratories are obligated to keep detailed records of received results, the procedure used for validation and statements if a given methodology is adequate for the intended application.[17]

With respect to court laboratories, detailed rules for the implementation and maintenance of the management system are found in the document DAB-10. This document has been developed in order to clarify the PCA's approach to the accreditation of forensic service providers, with particular emphasis on genetic testing and dactyloscopic examinations[18]. The key elements of the management system have been described in detail in this document.

The key role in a laboratory's management system is played by the personnel. The laboratory should ensure that every member of the personnel handling specific equipment, carrying out tests, evaluating results and signing reports should have relevant competencies. This is to be understood as qualifications, knowledge, training and experience. The laboratory should define what qualifications are necessary for a given position and be consistent in its recruitment process taking account of these parameters.

The next element of essential importance is a laboratory's policy on improving the qualifications of the personnel, both newly engaged and of longer service. The laboratory's management should define training needs, as well as plan and implement the same in a consistent manner.[19]

A laboratory should meet the requirements regarding venue conditions in which testing is carried out, both in terms of the number of rooms and separation of adjacent areas where activities are performed that cannot be reconciled. An obvious thing is having a separate room being the so-called material evidence storeroom. It is important to monitor ambient conditions (characteristic for individual rooms) in places where this affects test results. The above question is related to the optimal location of measuring and testing equipment, which should be complete for a given scope of testing. The supervision over this equipment pertains, among others, to performing checks, calibration and rating (executed for each instrument based on the manufacturer's recommendations and metrological rules).[20] Adequate measures should be undertaken in the laboratory to prevent contamination, e.g. automated pipettes and tips. It is also an obvious requirement to keep the laboratory clean and

17 DAB-07 Accreditation of test laboratories. Specific requirements, PCA, Issue 9, Warszawa 22.04.2016.

18 DAB-10 Accreditation of test laboratories – forensic service providers carrying out forensic activities, Issue 2 of 15.12.2020.

19 T. Bednarek, *Akredytacja laboratoriów wydających opinie kryminalistyczne*, "Prokuratura i Prawo" 2012, No 1, pp. 137-153.

20 DA-06 Policy of the Polish Centre for Accreditation on measuring coherence, PCA, Issue 6, Warszawa 27.01.2017.

orderly. A very important question is restricting access of unauthorized persons to the area where tests are performed.[21]

As a general rule applicable to accredited laboratories, they should perform tests within their scope of accreditation on their own. Only in exceptional cases, it is possible to subcontract one's own accredited tests and tests from outside one's own scope of accreditation to another accredited laboratory whose scope of accreditation covers the subcontracted tests, in accordance with one's own subcontracting procedure. The prerequisite is, however, to inform the Customer and obtain their written consent.[22]

The standard PN EN ISO/IEC 17025 imposes an obligation on the laboratory to apply test procedures that have been validated, whereas the uncertainty of the method used has been assessed. The validation is the confirmation, by examination and presentation of objective proof, that requirements have been fulfilled regarding the intended application. It confirms that the procedure used to perform a specific test is adequate for the intended application. The standard does not specify how validation of an analytic method should be carried out. According to the instruction of DAB-10, validation of genetic methods includes such methods, as stability, sensitivity, selectivity, repeatability, reproducibility, efficiency as well as detection and quantification limit.[23] It is worth mentioning that thanks to the assessment of the measurement uncertainty one may define the usefulness of a method for the performance of a given assay (the quality of results obtained by means of the validated method). The uncertainty of a method depends on factors affecting its value, e.g. imperfection of the method itself, incomplete knowledge of all factors that may disturb the measurement, the quality and technical capabilities of the laboratory apparatuses and equipment, the biological features of the tested material itself, as well as the level of training and experience of the personnel.[24] It needs to be emphasized that the validation of a test method allows for a more effective use of one's own resources which results in a desirable decrease of test costs, whereas the very process of validation interweaves with other elements of the management system. The requirements regarding measuring coherence correlate with the measurement uncertainty, as well as the internal and external quality control.

Acceptance of samples should take place via an authorized and trained employee, based on an order which is recorded in a way as to ensure unequivocal traceability.

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21 R. Włodarczyk, E. Rzeczyc, I. Sołtyszewski, *System zarządzania jakością a kryminalistyczne badania włosów*, "Problemy Kryminalistyki" 2009, Vol. 263, pp. 28-33.

22 M. Salmanowicz, *Budowa laboratorium krok po kroku*, LAB 2010, Vol. 4, pp. 38-40.

23 M. Spólnicka, R. Zbieć-Piekarska, *Proces walidacji w kryminalistycznych badaniach profilowania DNA*, "Problemy Kryminalistyki" 2008, Vol. 262, pp. 5-13.

24 M. Hołysz, *Walidacja metod badawczych i certyfikacja wyrobów do diagnostyki in vitro*, "Laboratorium" 2013, Vol. 9-10, pp. 2-7.

The laboratory must also demonstrate that it has implemented a system for informing customers of the methods, scope of tests and method of collecting a test report, etc. In the laboratory, it is necessary to introduce a system for the identification of samples accepted for testing. Every sample receives a unique code ensuring the customer's anonymity. Samples, as collected, must be legibly encoded, which allows to identify them at every stage of the testing process. Sample storage conditions should provide for the invariability of sample features. Following completion of the tests, the samples should be filed according to the agreement with the customer, whereas disposal of used chemical reagents and samples after the tests should take place in line with the instructions, as developed.

A laboratory is bound to develop a test quality control programme. The requirements of PN-EN ISO/IEC 17025 indicate the need to ensure the quality of test results at all stages of test execution. The development of an effective quality control programme should take account of test specificity. The quality of test results should be ensured at several levels. At the basic level, it is the person who performs the tests that is responsible for ensuring the quality, which can be effected, e.g., in the form of repeating the first sample in each batch and attaching it to the batch of positive and negative controls. In addition, archival samples may be subjected to reanalysis. The second level of quality assurance is provided by the laboratory manager by introducing an encoded control sample into a sample batch. The results of analyses of control samples at the first and second levels should be documented (e.g. in an analyst's work book and the substituted sample control card). The third level of quality control is the so-called External Quality Assurance (EQA) and it is executed by means of participation in proficiency testing (PT) interlaboratory comparison (ILC). All quality assurance levels constitute together quality control, which can be expressed in the form of the "quality strategy". The PCA treats PT/ILC as one of the basic elements of demonstrating technical competencies of accredited laboratories and it is a condition for obtaining and maintaining accreditation.[25] It should be underlined that presentation of tests results (the test report with an opinion) should be made according to a unified template in which there is information regarding: identification of the method applied, description, condition and unequivocal identification of the test object, date of acceptance of the test sample, date of performance of the test, results of the test and details of the person authorized to approve the test. The method of presenting test results should be legible and unequivocal. A copy of the report, to be found in the laboratory, should be linked to technical records ensuring the possibility to recreate the course of the test and establish the persons performing the same. It is important that all records pertaining to tests performed in the laboratory are easily

25 DA-05 Policy on participation in proficiency testing, PCA, Issue 6, Warszawa 22.04.2016.

accessible, traceable and stored in appropriate conditions. The form and content of the binding technical records (forms) should allow to recreate the course of the test in such conditions as close to those in which the test was performed for the first time. Collected archival data should be effectively protected from third persons' access. This also pertains to proper supervision over the laboratory IT equipment, including, e.g., LIMS (Laboratory Information Management System) software.[26]

Forms of assessment of the management system in a laboratory

The functioning of the management system in a laboratory is subject to both external assessment by the entity granting accreditation, and the internal one, comprising an internal audit and a management review. The notion of audit is to be understood as a systematic, objective and documented process of obtaining evidence that the management system, as implemented in the laboratory, meets the requirements of the standard PN EN ISO/IEC 17025, the PCA's documents and the laboratory's own system documents. The goal of the internal audit is to provide information whether the management system is implemented and being maintained effectively. Audits are a part of the ongoing process of improving the management system. The internal audit is a tool for improving the Laboratory's management system. Audit findings are a form of feedback for laboratory personnel, aiming to analyze procedures being executed and define areas requiring improvement. Internal audits are conducted according to the "Annual Internal Audit Programme". The Annual Audit Programme includes all elements of the management system and the technical area comprising tests being performed. Internal audits (if there is such a need, e.g. resulting from a necessity to improve the system or as a consequence of a well-grounded complaint, findings from the management review) may be organized outside the programme. While conducting an audit, the following order of actions must be observed:

a) establish facts (based on interviews, conversations, document examination, process execution observation, resource assessment, etc.);
b) record the facts and observations as evidence of the events that occurred during the audit;
c) evaluate the facts in order to identify whether there is objective evidence of inconsistencies to have occurred;
d) verify the execution of corrective actions from the previous audit.

According to the requirements of the standard, auditors may be persons meeting specific requirements and possessing competencies for conducting internal audits. The list of auditors and records of their qualifications should be supplemented on

26 K. Krassowski, I. Sołtyszewski, *LIMS jako narzędzie systemu zarządzania laboratorium kryminalistycznym*, "Problemy Kryminalistyki" 2011, Vol. 274 (4), pp.72-78.

an ongoing basis. On the basis of the internal audit report, if there is such a need, corrective and preventive actions are launched.

The management review is a process conducted by the management, taking place with a frequency as adopted by the laboratory.[27] The aim of the review is to evaluate conformity of the management system with the requirements of the standard PN-EN ISO/IEC 17025, as well as ensuring adequacy of the management system for the laboratory's quality policy, assessment of the effectiveness of procedures and execution of qualitative goals, and ensuring introduction of necessary changes and improvements. The key issue is to collect input data which should include an analysis of the changes of external and internal factors as relevant for the laboratory, assessment of the execution of the goals to have been assumed, usefulness of policies and procedures, status of actions taken in consequence of previous management reviews, results of last internal audits, corrective actions and assessment of the laboratory's operation by external organizations. On the other hand, output data from the management review should document all decisions and actions relating to the assessment of the effectiveness of the management system and its processes, improvement of the laboratory activity concerning the fulfilment of the requirements of the standard and provision of necessary resources for execution of the same. The management review is, therefore, an action which, through its regularity, planning and documentation management system in the laboratory. This process offers a possibility to analyze the entire system and is not only one of the requirements of the standard, but also a method of enhancing the same.

The assessment of the competencies of a test laboratory in the process of accreditation consists in verifying the fulfilment by the laboratory of the accreditation requirements and accreditation conditions in the area of documenting the management system and its implementation in the field of laboratory activity (sample testing/collection) as applied for the accreditation. A test laboratory should conduct a review of the documentation of the management system for conformity with the accreditation requirements. In the process of accreditation, the assessment of a test laboratory consists of the following: a review of laboratory-related documentation, an onsite assessment of the fulfilment of all accreditation requirements and accreditation conditions, observation of the execution of the laboratory activity as applied for the accreditation.

In the accreditation cycle, within the framework of the assessment in the planned supervision and reassessment, PCA verifies the maintenance by the laboratory of the competencies for sample testing/collection as comprised by the entire present

27 B. Zwierchanowska, *Utrzymanie wdrożonego systemu zarządzania w laboratorium wzorcującym*, "Prace Instytutu Techniki Budowlanej – Kwartalnik" 2010, Vol. 29154, pp. 49-54.

scope of accreditation, via the assessment of the fulfilment of all accreditation requirements and accreditation conditions, applying, as follows:

- a review of laboratory-related documentation (the scope of documentation delivered by the laboratory,
- onsite assessment of the fulfilment of accreditation requirements (interviews, reviews of documented information and records),
- observation of the execution of the laboratory activity as comprised by the current scope of accreditation.

Assessments in the planned supervision processes and reassessment are carried out in the scope and at the time as established in the laboratory assessment programme in a given accreditation cycle. The assessment programme is set in a manner to ensure that in a given accreditation cycle the accredited laboratory activity is assessed that is representative for the scope of accreditation as held by the laboratory, taking into account the locations/technical departments in which the activity is conducted, and that the accreditation requirements are assessed that are applicable. Samples of the laboratory activity and its location and samples of accreditation requirements as provided for assessment in the supervision programme, are established taking account of the risk related to: - the functioning of the laboratory management system, – the laboratory activity as conducted by the laboratory and its results (type, scope, significance), - locations/technical departments in which the activity is conducted, – personnel involved in the activity. Samples of the laboratory activity included in the supervision programme are representative for all test techniques in every field of testing and/or for all methods of sample collection. Supervision programmes take account of using all assessment techniques, including observations of the laboratory activity within the onsite assessment, a vertical audit of orders, a review of the laboratory documentation, a review of the results of the participation in PT/ILC and others. In addition, while developing the laboratory supervision programme, the existing knowledge of the PCA is taken into consideration regarding the functioning of the management system in the laboratory, the laboratory's operation and the execution and results of the laboratory activity as included in the scope of accreditation.

Conclusion

The question of the reliability of test as performed for the purposes of the administration of justice place a key role. Performance of tests in line with the principles of good laboratory practice, as well as correct reasoning performed by experienced expert witnesses, provide a necessary minimum in the testing of this kind. Due to the above, the key issue is to identify within the laboratory all potential reasons that may

have an adverse effect on the correctness of the result.[28] Essential in defining these reasons is human error. In order to avoid an error made by a person, tests should be performed in two-person teams by personnel having adequate skills and experience. It is also important to effect mutual control at every stage of the testing process.[29] Another problem may be a fault of a device, which should be taken into account during tests. Persons using devices are obligated to proceed according to test manuals and device user manuals, as well as to monitor the operation of devices. Laboratory practice shows that an error may also occur resulting from the quality of reagents used. For this purpose, it is necessary to control reagents upon purchase (conformity with the specification) and prior to introduction into testing (checking on archival samples).

Summing up, having a certificate of accreditation is not a kind of an attribute of infallibility, and accrediting of a specific testing procedure is not equivalent to the situation that the management system implemented in the laboratory is absolutely perfect and will never let us down. Therefore, the key element of the system is the ongoing process of improving the management system, with particular emphasis on audit activities and management reviews.

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28 M. Plebani, *The detection and prevention of errors in laboratory medicine*, "Ann Clin Biochem" 2010, Mar;47(Pt 2), pp. 101-110. DOI: 10.1258/acb.2009.009222. Epub 2009 Dec 1.

29 T. Tomaszewski, *Kwalifikacje biegłych wydających opinie kryminalistyczne*, in: E. Gruza, J. Tomaszewski (eds.), *Problemy Współczesnej Kryminalistyki*, Vol. 3, Warszawa 2000.

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BIOLOGICAL ANALYSES IN FORENSIC SCIENCE

APPLICATION OF miRNAs TO BODY FLUID IDENTIFICATION

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Introduction

At present, forensic DNA analysis is considered necessary in forensic laboratories in case of identification of persons from biological samples linked to crimes. It appears, however, that in proving a criminal act it is very important from what body fluid the isolated DNA originates.[1] The definition of the type and origin of body fluids secured at the crime scene may be essential in many cases to establish the relation between evidentiary material and the suspect.[2] Enzymatic methods have been used for years as presumptive tests to identify body fluids, whereas serological and histological methods, using the microscope, serve as confirmatory tests. Yet, these are flawed, frequently producing false-positive results. An example may be a saliva detection test, based on the presence of the α-amylase enzyme. The activity of this enzyme may be found not only in the saliva, but also in cosmetics or human excreta, such as faeces and urine.[3] Another example refers to the acid phosphatase (AP) test which is widely used for recovering semen traces. This test may also yield false-positives, since

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1 K. Sakurada, K. Watanabe, T. Akutsu, *Current methods for body fluid identification related to sexual crime: focusing on saliva, semen, and vaginal fluid,* "Diagnostics (Basel)" 2020, Vol. 10(9), p. 693.

2 J.H. An, K-J. Shin, W.I. Yang, H.Y. Lee, *Body fluid identification in forensics*, BMB Reports 2012, Vol. 45 (10), pp. 545-553.

3 J. Hedman, K. Gustavsson, R. Ansell, "Using the new Phadebas® Forensic Press test to find crime scene saliva stains suitable for DNA analysis", *Forensic Science International: Genetics Supplement* 2008, Vol. 1, pp. 430-432; J.R. Myers, W.K. Adkins, *Comparison of modern techniques for saliva screening,* "Journal of Forensic Sciences" 2008, Vol. 53, pp. 862-867.

the enzyme under examination may also be found in vaginal discharge.[4] Also tests based on detection of the prostate-specific antigen (PSA) give presumptive results, because its low concentrations can be found in female urine, as well as breast milk.[5] A similar situation is with luminol used to detect blood which can also react with other substances containing copper as well as plant and animal proteins. In addition, it has been demonstrated to have an adverse effect on DNA analyses.[6]

Due to the inaccuracies in body fluid identification results and the fact that the newest methods of DNA typing allow to obtain results from small, degraded and even very old samples, it is necessary to develop new methods of tissue and body fluid identification. Over the past few years, methods have been developed which use immunochromatography and molecular biology at tissue-specific mRNA and microRNA expression levels, as well as DNA methylation. Some problems have emerged in the course of the research, however: DNA methylation requires a high concentration of template DNA, which is difficult to achieve from a small sample, whereas in the case of mRNA, the problem was the stability of the molecule which became degraded quickly1.[7] This has not been observed in miRNA analyses due to their small size (circa 20 nt). miRNA profiling was introduced to body fluid identification in 2009[8] and research has been done until today to use the potential of this molecule in forensic tests as well.[9] Another important fact is that it has been made possible to develop methods that enable simultaneous isolation of DNA and miRNA from one sample,[10] which allows DNA profiling and body fluid identification.

This study presents the characteristics of miRNA molecules and their use as biomarkers for the identification of body fluids.

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4 J.H. An, K-J. Shin, W.I. Yang, H.Y. Lee, *Body…*, pp. 545-553.

5 M. Yokota, T. Mitani, H. Tsujita, T. Kobayashi, T. Higuchi, A. Akane, M. Nasu, *Evaluation of prostate-specific antigen (PSA) membrane test for forensic examination of semen*, "Legal Med (Tokyo)" 2001, Vol. 32001, pp. 171-176.

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miRNA – biogenesis

miRNAs are short, of 18-24nucleotides, ncRNAs (non-coding RNAs) that may regulate gene expression by means of posttranscriptional silencing. In the human genome there are fewer than 3,000 genes coding miRNAs.[11]They are mostly coded within intron sequences, but can also be located inside exons, as well as in intragenic regions.[12] miRNA can be created in one of the two biogenesis pathways. Out of the two ways, the canonical dominates, in which genes coding miRNAs are transcribed which results in the creation of pri-miRNAs (primary miRNAs), whose length is at least 200 nucleotides. Thereafter the Drosha-DGCR8 complex dicespri-miRNAs into sections of an average length varying around 65 nucleotides, which form a hairpin structure being already precursor miRNA (pre-miRNA). The resultant pre-miRNA is then exported from the cell nucleus to the cytoplasm thanks to the activity ofexportin-5 and RAN-GTP. When pre-miRNA gets to the cytoplasm, ribonuclease III – Dicer – in combination with its cofactor TRBP, cleaves the terminal loop of the precursor miRNA molecule. As a result, the miRNA/miRNA* duplex is created consisting of the miRNA guide strand and the miRNA* passenger strand. The double-stranded duplex is bound to the protein Agronaute (AGO), thereby including miRNA into the RISC complex, while the passenger molecule – miRNA* –is released and becomes degraded. Thus, in the canonical pathway, we obtain a molecule of mature miRNA which, in a complex with AGO2, in case there is complementarity, is capable of degrading mRNA or inhibiting its translation.[13] In case of a non-canonical way, we deal, in part, with the same proteins which participated in the canonical pathway, however in a different configuration. We can distinguish the Drosha/DGCR8-independent biogenesis, in which the resultant pre-miRNA originates from Dicer substrates which may include the mirtron, that is the product of splicing from mRNA introns or the m^7G-cap. These molecules do not have to undergo dicing by the enzyme Drosha and are transported right away with the help of exportin-1 to the cytoplasm. In the enzyme Dicer-independent biogenesis, miRNA comes from the processed shRNA (short-hairpin RNA) through the activity of the enzyme Drosha. This type of precursor miRNA is too short to become a substrate for the enzyme

11 C.L. Glynn, *Potential…*, pp. 1-9.

12 C. Zhao, S. Xinlei, L. Li, *Biogenesis and function of extracellular miRNAs*, "ExRNA" 2019, Vol. 1, p. 38; J. O'Brien, H. Hayder, Y. Zayed, C. Peng, *Overview of microRNA biogenesis, mechanisms of actions, and circulation*, "Frontiers Endocrinology" 2018, Vol. 9, p. 402; T. Sijen, *Molecular approaches for forensic cell type identification: On mRNA, miRNA, DNA methylation and microbial markers*, "Forensic Science International: Genetics" 2015, Vol. 18, pp. 21-32.

13 J. O'Brien, H. Hayder, Y. Zayed, C. Peng, *Overview…*, p. 402; C. Zhao, S. Xinlei, L. Li, *Biogenesis…*, p. 38; T.D. Lao, T.A.H. Le, *MicroRNAs: biogenesis, functions and potential biomarkers for early screening, prognosis and therapeutic molecular monitoring of nasopharyngeal carcinoma*, "Processes" 2020, Vol. 8(8), p. 966.

Dicer, that is why the protein AGO2 is necessary for the successful creation of mature miRNA. Thus the maturing of pre-miRNA, as created in this way, is completed with the participation of AGO2, which comes from the molecule originating from strand3'. 3′-to-5′ trimming favours simultaneous maturation of the molecule from strand 5'.[14] Irrespective of the type of biogenesis, the mature miRNA molecule remains bound to AGO2 making up themiRISC complex (microRNA induced silencing complex). The activity of this protein complex provides the key mechanism for the function fulfilled by miRNA. Gene expression is controlled posttranscriptionally resulting from the reaction between the 5'region of miRNA and a molecular target in the form of the 3'UTR mRNA sequence, which is an untranslated region. When full complementarity occurs between the two molecules, AGO2 is activated by dicing the mRNA molecule, which results in its degradation. In case miRNA comprising a part of the miRISC complex is not fully complementary with the target mRNA, the same does not become degraded, but the translation of this mRNA molecule is suspended.[15]

miRNA – body fluid identification

A particularly important feature of miRNA, resulting from the function fulfilled by miRNA, playing a significant role in body fluid identification, is high tissue specificity (although we know miRNA types that are universal for various tissues and cells), as well as stability and resistance to degradation, which allows analysis of even a highly degraded biological material. This makes it a specific biomarker.[16]

The miRNA analysis is performed by means of profiling methods which include microarray techniques or NGS –next-generation sequencing, enabling the detection of hundreds of miRNAs within one experiment. In order to analyze several selected miRNAs, the quantitative Real-Time PCR (qRT-PCR) is used which is characterized by high sensitivity and repeatability of results[17]. In case of application of this

14 J. O'Brien, H. Hayder, Y. Zayed, C. Peng, *Overview*…, p. 402.

15 T.D. Lao, T.A.H. Le, *MicroRNAs*…p. 966; Y. Kim, V.N. Kim, *MicroRNA factory: RISC assembly from precursor microRNAs*, "Molecular Cell" 2012, Vol. 46(4), pp. 384-386; A. Grenda, M. Budzyński, A.A. Filip, *Biogeneza cząsteczek mikroRNA oraz ich znaczenie w powstawaniu i przebiegu wybranych zaburzeń hematologicznych*, "Postępy Higieny i Medycyny Doświadczalnej" 2013, Vol. 67, pp. 174-185.

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technique, it is important to select appropriate reference genes. The expression of these genes should demonstrate a constant level for respective fluids/tissues/cells, therefore these genes most frequently represent ones of basal cellular metabolism. Thanks to this, it is possible to allow for and correct mistakes that may overstate or understate the expression results of the genes under examination.[18] It is more favourable for analyses to use more than one reference gene, this enables a more precise and reliable standardization of the data obtained.[19]

The advantage of miRNA as a biomarker used for the identification of body fluids from biological traces is the fact that commercial isolation kits are already available enabling simultaneous extraction of DNA and RNA from one test material sample, which is useful in case of degraded specimens and with a small number of forensic traces, this reduces the risk of using up the material below the minimum value as necessary to obtain a DNA profile.[20]

Initially, there was a search for miRNAs specific exclusively for one body fluid, however, a majority of tested miRNAs did not fulfil this criterion. At present, miRNA biomarkers are sought which demonstrate a higher expression in a specific body fluid (as compared to controls), and a lower one in other body fluids. In recent years, a great number of tests have been carried out in which body fluids are identified by means of miRNA profiling.[21]

miRNA biomarkers in selected body fluids

Saliva

Research done since 2009, aiming at searching for tissue-specific miRNA markers, has not brought conclusive results for saliva. Analysis of the expression of miR583,

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19 H. Schwarzenbach, A. Machado da Silva, G. Calin, K. Pantel, *Data normalization strategies for microRNA quantification*, "Clinical Chemistry" 2015, Vol. 61(11), pp. 1333-1342.

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miR518c*, miR208b, miR9*, as well as miR658, miR205, miR16, has not demonstrated specificity for saliva.[22] Courts et al. showed that application of miR200c, miR203, miR205 allows saliva identification if the comparative body fluid is venous blood.[23] Next research demonstrated that the expression of these miRNAs was at a similar or higher level in vaginal discharge, as well as in menstrual blood.[24] The difficulty in differentiating these fluids results from their histological and biochemical similarity. Similarly, analysis of miR203, miR205 and miR124* has not demonstrated the specificity of these molecules only for saliva.[25] An examination of the miR943 expression revealed a significantly elevated expression in saliva material, although for the skin as well. However, analysis of the expression of miR205 and miR451 allows to distinguish saliva in a mixture with blood.[26] Research confirmed the nonspecific character of miR200, miR205 and miR658, not only as a salivary biomarker, but also as a biomarker of human saliva, since the expression of these molecules occurs in animals as well.[27] The search for a tissue-specific marker implies analyzing a number of molecules, of which only very few are subjected to further examination. Among the analyzed miRNAs: miR200c-3p, miR203a-3p, miR205, miR223-3p, miR658, a high expression in saliva was only obtained formiR203a-3p and miR223-3p, however, a similar effect was also obtained in vaginal discharge.[28] This discriminates these miRNAs as absolutely specific, still, based on them, it is possible to distinguish saliva from venous blood and semen. Potential biomarkers for saliva are presented in Table No 1.

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22 D. Zubakov, A.W.M. Boersma, Y. Choi, P.F. van Kuijk, E.A.C. Wiemer, M. Kayser, *MicroRNA markers for forensic body fluid identification obtained from microarray screening and quantitative RT-PCR confirmation*, "The International Journal of Legal Medicine" 2010, Vol. 124(3), pp. 217-226; Z. Wang, H. Luo, X. Pan, M. Liao, Y. Hou, *A model for data analysis of microRNA expression in forensic body fluid identification*, "Forensic Science International: Genetics" 2012, Vol. 6(3), pp. 419-423; Z. Wang, J. Zhang, W. Wei, D. Zhou, H. Luo, X. Chen, Y. Hou, *Identification of saliva using microRNA biomarkers for forensic purpose*, "Journal of Forensic Sciences" 2015, Vol. 60(3), pp. 702-706.

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24 Z. Wang, J. Zhang, W. Wei, D. Zhou, H. Luo, X. Chen, Y. Hou, *Identification…*, pp. 702-706.

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Table 1. miRNA demonstrating potential as a salivary biomarker

miRNA	References
miR658, miR205	Hanson et al. 2009
miR583, miR518c*, miR208b	Zubakov et al. 2010
miR200c, miR203, miR205	Courts and Madea 2009
miR16, miR658, miR205	Wang et al. 2012
miR205-5p, miR658, miR200c-3p, miR203a, miR138-2, miR146b-3p, miR206, miR639	Wang et al. 2015
miR451, miR205	Williams et al. 2013
miR203a-3p, miR124-3p	Sauer et al. 2015
miR203a-3p, miR200c-3p, miR205-5p, miR223-3p, miR658	Fujimoto et al. 2019
miR205, miR658, miR200c	Peng et al. 2015
miR182*, miR622, miR141, miR26a, miR145*, miR135b*, miR381, miR96*, miR1228, miR431*, miR450b-5p	Weber et al. 2010
miR124*, miR203, miR205	Sirker et al. 2017
miR451, miR412, miR891a, miR205, miR124a	O'Leary and Glynn 2018
miR205	Mayes et al. 2018

Source: own study based on the listed literature.

Blood

In order to identify blood with the use of miRNA, the level of expression has been examined of a number of molecules (Tab. 2.), with respect to which there is less doubt about the lack of an identification potential than the actual uniqueness for blood. Blood identification requires the selection of molecules that are specific not only for this body fluid but also for its particular types, including venous and menstrual blood. Analyses have ruled out identifiability with the use ofmiR518[29]or miR150-5p[30]. A research on over 200 miRNA molecules for the purpose of application in forensic medicine was conducted by Park et al. (2014), presenting, as optimal blood biomarkers, the molecules miR848 and miR182.[31] Over a span of many years, independent research has proved that for venous blood high expression, exceeding one in other body fluids, is demonstrated by miR16, miR451, miR20a, miR106a,

29 D. Zubakov, A.W.M. Boersma, Y. Choi, P.F. van Kuijk, E.A.C. Wiemer, M. Kayser, *MicroRNA markers for forensic body fluid identification obtained from microarray screening and quantitative RT-PCR confirmation*, "The International Journal of Legal Medicine" 2010, Vol. 124(3), pp. 217-226; J.A. Weber, D.H. Baxter, S. Zhang, D.Y. Huang, K.H. Huang, M.J. Lee, D.J. Galas, K. Wang, *The microRNA spectrum in 12 body fluids*, "Clinical Chemistry" 2010, Vol. 56(11), pp. 1733-1741.

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miR185.[32] The expression results are not uniform in all research, some tests show that miR16 does not allow to distinguish venous blood from menstrual one,[33] others indicate that the difference in the expression of miR16 for these two types of blood is distinct and unequivocal –in favour of venous blood.[34]

For the purpose of distinguishing menstrual blood from venous blood, simultaneous use of more than one miRNA molecule has been tested. The analysed differentiating molecule combinations included miR451 and miR412,[35] miR451a, 141-3p, miR142-3p.[36] This research, too, resulted in different results, for some analyses identified menstrual blood on the basis of the lack of miR142-3p,[37] whereas others demonstrated an increased expression of miR142-3p also in menstrual blood,[38] and it was even shown that this molecule demonstrates specificity only for blood.[39] A number of analyses of other miRNA molecules: miR205, miR203a, miR200-3p,[40] miR185[41] indicated their nonspecificity with respect to menstrual blood. The search for a single, reliable marker pointed at only one candidate – miR412.[42] Potential biomarkers for blood are presented in Table No 2.

32 E.K. Hanson, H. Lubenow, J. Ballantyne, *Identification of forensically relevant body fluids using a panel of differentially expressed microRNAs*, "Analytical Biochemistry" 2009, Vol. 387(2), pp. 303-314; D. Zubakov, A.W.M. Boersma, Y. Choi, P.F. van Kuijk, E.A.C. Wiemer, M. Kayser, *MicroRNA markers for forensic body fluid identification obtained from microarray screening and quantitative RT-PCR confirmation*, "The International Journal of Legal Medicine" 2010, Vol. 124(3), pp. 217-226; Z. Wang, H. Luo, X. Pan, M. Liao, Y. Hou, *A model for data analysis of microRNA expression in forensic body fluid identification*, "Forensic Science International: Genetics" 2012, Vol. 6(3), pp. 419-423; M. Sirker, R. Fimmers, P.M. Schneider, I. Gomes, *Evaluating the forensic application of 19 target microRNAs as biomarkers in body fluid and tissue identification*, "Forensic Science International: Genetics" 2017, Vol. 27, pp. 41-49; L. Cheng, R.A. Sharples, B.J. Scicluna, A.F. Hill, *Exosomes…*; K.R. O'Leary, C.L. Glynn, *Investigating the isolation and amplification of MicroRNAs for Forensic Body Fluid Identification*, "Microrna" 2018, Vol. 7(3), pp. 187-194.

33 M. Sirker, R. Fimmers, P.M. Schneider, I. Gomes, *Evaluating…*, pp. 41-49.

34 Z. Wang, H. Luo, X. Pan, M. Liao, Y. Hou, *'A model for data analysis…*, pp. 419-423.

35 K.R. O'Leary, C.L. Glynn, *Investigating the isolation and amplification of MicroRNAs…*, pp. 187-194.

36 C. Mayes, S. Seashols-Williams, S. Hughes-Stamm, *A capillary electrophoresis method…*, pp. 1-4.

37 *Ibidem*, pp. 1-4.

38 M. Sirker, R. Fimmers, P.M. Schneider, I. Gomes, *Evaluating…*, pp. 41-49.

39 D.J. van der Meer, G.A. Williams, *Performing body fluid identification with microRNAs using capillary electrophoresis*, "Forensic Science International: Genetics Supplement Series" 2015, pp. e592-e594.

40 Z. Wang, J. Zhang, W. Wei, D. Zhou, H. Luo, X. Chen, Y. Hou, *Identification of saliva…*, pp. 702-706.

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Table 2. miRNA demonstrating potential as a blood biomarker

miR451, miR16	Hanson et al. 2009
miR451, miR412 (for menstrual blood)	
miR20a, miR106a, miR185	Zubakov et al. 2010
miR185*, miR144 (for menstrual blood)	
miR126, miR150, miR451	Courts and Madea 2011
miR16, miR658, miR205	Wang et al. 2012
miR451, miR205	Williams et al. 2013
miR144-3p, miR203-3p	Sauer et al. 2015
miR16-5p, miR144-3p, miR451a-5p	Fujimoto et al. 2019
miR16, miR451	Sirker et al. 2017
miR142-3p, miR185 (for menstrual blood)	
miR145, miR181c, miR199a, miR1183	Antônio et al. 2019
miR451, miR412, miR891a, miR205, miR124a	O'Leary and Glynn 2018
miR451a, miR142-3p	Mayes et al. 2018
miR141-3p, miR412-3p (for menstrual blood)	

Source: own study based on the listed literture.

Semen

Research into the identification of semen has been based on analysis of a number of miRNA molecules (Tab. 3). Many of them, among others miR205, miR10b, miR135b, miR200c-3p, miR203a, miR124a, have not demonstrated specificity supported by a unique expression in semen as compared to other body fluids.[43] It has been stated, on the other hand, that the following can be considered seminal biomarkers: miR135a, miR10a, miR507, miR891a-5p and miR943. These miRNAs-demonstrated overexpression in semen samples in comparison with the expression of specimens originating from other body fluids, i.e. venous and menstrual blood, vaginal discharge and saliva. Results for saliva analyses with the use of these miRNAs were concordant both by applying the RT-PCR method and microarrays[44].The unique miRNA molecule for semen is also miR508-5p, whose expression has not been found in any other material under examination, although the analysis included specimens coming from amniotic fluid, breast milk, bronchial fluid, cerebrospinal

43 E.K. Hanson, H. Lubenow, J. Ballantyne, 'Identification of forensically relevant body fluids using a panel of differentially expressed microRNAs'…, pp. 303-314; M. Sirker, R. Fimmers, P.M. Schneider, I. Gomes, 'Evaluating the forensic application of 19 target microRNAs as biomarkers in body fluid and tissue identification'…, pp. 41-49; K.R. O'Leary, C.L. Glynn, *Investigating the isolation and amplification of MicroRNAs*…, pp. 187-194; Z. Wang, J. Zhang, W. Wei, D. Zhou, H. Luo, X. Chen, Y. Hou, *Identification*…, pp. 702-706.

44 D. Zubakov, A.W.M. Boersma, Y. Choi, P.F. van Kuijk, E.A.C. Wiemer, M. Kayser, *MicroRNA markers*…, pp. 217-226; E. Sauer, A.K. Reinke, C. Courts, *Validation of forensic body fluid identification based on empirically normalized miRNA expression data*…, pp. 462-464.

fluid, peritoneal fluid, plasma, pleural fluid, saliva, tears and urine[45].Other research offered thepossibility of making use of miR888-5p in semen identification and confirmed the application of miR891a-5p. miR888-5p underwent expression specifically in semen, whereas in other examined materials it was absent or at a minimal level[46]. Potential biomarkers for semen are presented in Table No 3.

Table 3. miRNA demonstrating potential as a seminal biomarker

miR135b, miR10b	Hanson et al. 2009
miR943, miR135a, miR10a, miR507	Zubakovet al. 2010
miR16, miR658, miR205	Wang et al. 2012
miR891a-5p	Sauer et al. 2015
miR10a-5p, miR888-5p, miR891a-5p	Fujimoto et al. 2019
miR508-5p, miR644, miR17, miR380*, miR340, miR29b-2*	Weber et al. 2010
miR10b, miR943	Sirkeret al. 2017
miR451, miR412, miR891a, miR205, miR124a	O'Leary and Glynn 2018
miR891a, miR10b	Mayes et al. 2018

Source: own study based on the listed literture.

Vaginal discharge

Analysis of the miR124a and miR372 expressions has pointed at miR124a as useful for the identification of vaginal discharge, even in comparison with tissues that bear a resemblance, e.g. oral epithelium.[47] Another research has based itself on miR617 and miR891a, but neither of them demonstrated specificity for vaginal discharge. In case of an analysis of miR617 on the microarray, the molecule has proved its worth as a candidate for identification, but this result has not been confirmed through the application of the RT-PCR, whereas miR891a demonstrated also a high expression in other body fluids, e.g. semen.[48] Wang et al. (2015), identifying specific markers for saliva, applied, among others, vaginal discharge as a comparative body fluid. The results in this body fluid showed a high expression of miR205-5p (comparable to menstrual blood), which considerably exceeded the expression of this miRNA in samples of semen and saliva, and, in addition, was absent in venous blood.[49] The potentially best result was obtained with the use ofmiR200c-3p, whose expression

45 J.A. Weber, D.H. Baxter, S. Zhang, D.Y. Huang, K.H. Huang, M.J. Lee, D.J. Galas, K. Wang, *The microRNA spectrum in 12 body fluids*…, pp. 1733-1741.

46 S. Fujimoto, S. Manabe, C. Morimoto, M. Ozeki, Y. Hamano, E. Hirai, H. Kotani, K. Tamaki, *Distinct spectrum of microRNA expression in forensically relevant body fluids and probabilistic discriminant approach*, "Scientific Reports" 2019, Vol. 9(1), p. 14332.

47 Z. Wang, H. Luo, X. Pan, M. Liao, Y. Hou, "A model for data analysis of microRNA…, pp. 419-423.

48 D. Zubakov, A.W.M. Boersma, Y. Choi, P.F. van Kuijk, E.A.C. Wiemer, M. Kayser, "MicroRNA markers, pp. 217-226.

49 Z. Wang, J. Zhang, W. Wei, D. Zhou, H. Luo, X. Chen, Y. Hou, "Identification of saliva…, pp. 702-706.

was clearly higher as compared to the other body fluids. Analyzing the expression of miR155-5p and miR1260b, it was stated that the former demonstrated a similar expression in many body fluids, so it did not have a discriminating power. On the other hand, miR1260b demonstrated a higher expression in vaginal discharge, yet it was also observed in semen and saliva. In order to facilitate the identification of vaginal discharge, additional analysis is suggested with such miRNAs as: miR203a-3p and miR888-5p.[50] Next potential vaginal discharge biomarker molecules under test have included miR1280andmiR4286, ruled out as potential markers by Sirkeret al. (2017) due to their nonspecific expression presenting a similar level both in vaginal discharge and menstrual blood. miR891a, miR205 and miR124a expressions have also been demonstrated in vaginal discharge, however to a nonspecific degree.[51] Potential biomarkers for vaginal discharge are presented in Table No 4.

Table 4. miRNA demonstrating potential as a vaginal discharge biomarker

miR195, miR372, miR124a	Hanson et al. 2009
miR617, miR891a	Zubakovet al. 2010
miR16, miR658, miR205	Wang et al. 2012
miR203a-3p, miR124-3p	Sauer et al. 2015
miR124-3p, miR155-5p, miR1260b, miR3685	Fujimoto et al. 2019
miR1280, miR4286	Sirker et al. 2017
miR451, miR412, miR891a, miR205, miR124a	O'Leary and Glynn 2018

Source: own study based on the listed literture.

miRNA in the determination of the time of death

miRNA may be applied in forensics not only to identify body fluids or other tissues, but it can also play a role in determining the time of death.[52] Research has shown that potential markers may include miR1-2, whose expression was detected at the same level up to 120 hours after death, afterwards its level decreased,[53] or the expression of miR206 and miR133, which was reduced greatly 24 hours after death.[54] Also let7e and miR16 expressions have been examined in human bone material from corpses

50 S. Fujimoto, S. Manabe, C. Morimoto, M. Ozeki, Y. Hamano, E. Hirai, H. Kotani, K. Tamaki, "Distinct spectrum of microRNA…, p. 14332.

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54 H. Wang, J. Mao, Y. Li, H. Luo, J. Wu, M. Liao, W. Liang, L. Zhang, *5 miRNA expression analyze in post--mortem interval (PMI) within 48h*, "Forensic Science International: Genetics Supplement Series" 2013, No 4(1), pp. e190-e191.

with a high degree of decomposition. Differences in the expression of these miRNAs enabled the specification of four intervals of the time that has elapsed since an individual's death – under one month, between one and three months, between three and six months, over six months. The results showed a clear difference between the first interval and the remaining three, where, with time passing after death, the expression of let7e and miR16 was decreasing.[55]

The level miRNA expression may also indicate the time of death as to the part of the day: day or night. And so, examining the human vitreous body, a lower expression of miR142-5p and mir541 has been obtained in the case of material originating from deaths occurring during the day, whereas the expression in material coming from night deaths has been higher. In addition, these molecules were stable at least for 24 hours after death.[56]

Conclusion

The body fluid identification system based on microRNAs has a big potential in forensic practice due to their specificity, stability and low susceptibility to degradation. The fact is important which has been mentioned previously that coextraction is possible of DNA for STR analysis and miRNA for body fluid from one sample,[57] to be analyzed afterwards on the basis of capillary electrophoresis [58]. The lack of methodological standardization is a big problem in miRNA analysis, which brings about variable results in case of different research teams. Further miRNA analyses should focus on the validation and standardization of methods used in forensic laboratories, starting with sample collection, through miRNA extraction and quantification methods.

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GENETIC ANALYSIS METHODS USED IN FORENSIC ENTOMOLOGY

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Introduction

This study aims at a presentation of the role of forensic entomology in the investigation and the possibilities of molecular identification of necrophagous insects. This field, forgotten for many years, is taken into consideration again in the investigation. Unfortunately, there are very few entomology expert witnesses nowadays. A way out of the difficult situation may be training experts in the molecular identification of insects.

A historical overview of research on necrophagous fauna

The first documented application of forensic entomology knowledge in investigating crime dates back to medieval China.[1] Sung Tz'u, a lawyer and death investigator living in the 13th century, in his book, *Hsi yüan chi lu*, described a case regarding a murder of a peasant working in a rice field. During the investigation, flies started coming down to one peasant's sickle, attracted to the scent of blood stains which were invisible to the human eye. That allowed to discover the perpetrator of the murder.[2]

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1 B.E. McKnight, *The washing away of wrongs: forensic medicine in thirteenth-century China*, University of Michigan, Ann Arbor 1981.

2 M. Benecke, *A brief survey of the history of forensic entomology*, "Acta Biologica Benrodis" 2008, Vol. 14, pp. 15-38.

The beginnings of forensic entomology in Europe fall on the turn of the 18th and 19th centuries, when the remarkably rapid development of biological sciences started. The Swedish natural scientist Carl von Linné, in his *Systema Naturae* (10th edition), undertook to classify necrophagous beetles into the genus *Silpha* (the Coleoptera) and a few species of the housefly into the genus *Musca* (the Diptera). Linné is also the author of the famous sentence that "three flies would destroy a horse as fast as a lion would".[3] The most dynamic progress in forensic entomology occurred in France at the end of the 19th century. At that time, among others, the first report was made by the French doctor Bergeret in an attempt to determine the post mortem interval (PMI). He estimated the time of death of a newborn, found during renovation work behind a fireplace, based on fly pupae and moth larvae. And although he did not avoid making a mistake, assuming that the life cycle of these insects lasts the whole year, still he noticed a regularity regarding the succession of insects populating dead bodies: blow flies lay eggs on the fresh corpse, whereas moths prefer desiccated corpses.[4] It was also France where the first forensic entomology handbook was published, *La Faune des Cadavres* by Jean Pierre Mégnin, of 1894, in which the author described the succession of arthropods on unburied, buried or submerged corpses. In addition, Mégnin created a key for the species-specific identification of necrophagous insects on the basis of their morphological characteristics, both for larvae and for adults, and proposed a method of application of entomology as a useful tool in forensic medicine. Great achievements in the study of necrophagous fauna were made by the German researchers – Maschka (1881) and Klingelhöffer (1898), as well as the Polish pathologist – Horoszkiewicz (1902). Their research concerned mostly cockroaches and termites (the Blattodea) and ants (the Formicidae). The prominent Polish entomologist – Lubicz-Niezabitowski (1902), conducted the first experiments in forensic entomology, using for this purpose human foetuses, dead rats, cats, foxes and cattle. He analyzed stages of dead body colonization by various species of flies and beetles. Niezabitowski proved as well that the fauna populating human corpses and vertebrate carcasses do not demonstrate significant differences as regards species composition, and the succession stages are analogous.[5]

The interest in forensic entomology slightly decreased in the inter-and post-war periods. At present, forensic entomology is still developing, whereas modern molecular analysis techniques enable decidedly wider utilization of necrophagous fauna in evidentiary proceedings. This science has long stopped being used only for the determination of the PMI, it allows obtaining information about the place and

3 M. Benecke, M. Leclercq, *Ursprünge der modern angewandten rechtsmedizinisch-kriminalistischen Gliedertierkunde bis zur Wende zum 20. Jahrhundert,* "Rechtsmedizin" 1999, Vol. 9, pp. 41-45.

4 M. Benecke, *A brief survey of the history…*, pp. 15-38.

5 Ibidem, Item 4.

circumstances of death, the corpse being moved, determination of the cause of death, or even DNA profiling of a victim on whom necrophagous insect larvae have fed.[6]

Postmortem changes in the human body – pathophysiology of death

Late postmortem changes are related to the decomposition of a corpse. The decay is a continuous process, lasting from the moment of death until the skeletonization of the corpse. The decompositional changes usually demonstrate themselves after ca. 24 hours, however this is not a rule. Two processes contribute mainly to the decomposition: autolysis, resulting from the action of enzymes released after the person's death, and rotting – the result of microorganisms' activity. The latter may be of internal origin, but these may also be bacteria, fungi, or necrophagous insects which are found in the natural environment. Their presence speeds up the process of decay.[7] Environmental factors play an important role in the decomposition process. They can also significantly affect the assessment of a situation by a forensic pathologist or expert witness.

Biology of necrophagous insects – insects vs death

A forensic pathologist is able to estimate the time of death within the first 72 hours of the moment of death. After the lapse of this time it is more difficult, first of all due to the change of the body's temperature and the initiation of the processes of decay. Other disciplines come to his/her aid, including forensic entomology. Entomological testing is based mostly on the species-specific identification of insects and knowledge regarding their life cycle.[8]

Insect development proceeds through a series of developmental stages, starting with an egg up to an adult specimen. The duration of each developmental stage is dependent on the species, but also on environmental factors. An increase in ambient temperature, wind speed, precipitation, the type of tissue on which larvae feed, or the presence of various chemical substances, including also medication taken by the

6 Ibidem, Item 4.

7 J. Dix, *Handbook for Death Scene Investigators*, Boca Raton, FL 1999.

8 D. Gennard, *Forensic Entomology: An Introduction*, First Edition. West Sussex, United Kingdom 2012.

deceased, may significantly affect the development of necrophagous fauna, e.g. by shortening or extending the duration of respective developmental periods.[9]

The insects that are important from the point of view of forensic entomology, i.e. flies (the Diptera) and beetles (the Coleoptera) undergo complete metamorphosis. Flies belonging to the families Calliphoridae (blow flies), Sarcophagidae (flesh flies) and Muscidae (house flies) go through 4 developmental stages: egg, larva, pupa, and imago. Eggs are laid in very large numbers in dead bodies, faeces, or rotten material. The female stays with the eggs until they hatch into larvae. The larvae go through three larval stages, the so-called instars. The transition into each successive larval stage is preceded by shedding the exeoskeleton. Larvae ready to pupate migrate into the soil where they dwell for the entire duration of this stage. It happens that puparia are found in the deceased person's clothes, under a carpet or furniture, in case the deceased was located in a room. From puparia emerge adults. In case of the third larval stage, it may happen that developed larvae are forced to seek another source of nourishment, if they have not reached the weight necessary for pupation. Larvae disperse and start seeking a suitable place for the pupation.[10] To understand the phenomenon of larval dispersal, as well as factors affecting is (among others, rivalry, cases of cannibalism, photoperiod, larval concentration on corpses, etc.) is helpful for the investigation, because the distance ofthe pupation from the corpse influences its time which, in turn, has an effect on later determination of the PMI.[11]

The life cycle of beetles also consists of 4 stages, however it progresses in a slightly different way than in flies. The egg and pupal stages take place in well-hidden and protected places. Larvae, on the other hand, dwell underground or under the corpse, in contact with fluids coming from the corpse.[12]

On the basis of feeding preference, Goff [13] distinguished four types of dependence between the decomposing body and athropods:

a) necrophagous species (flies from the families Calliphoridae, Sarcophagidae, beetles from the families Silphidae, Dermestidae);

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9 J.L. Castner, *General Entomology and Insect Biology*, in: J.H. Byrd and J.L. Castner (eds.), *Forensic Entomology: The Utility of Arthropods in Legal Investigations*, Boca Raton 2009, pp. 17-38; L.M. Carvalho, A.X. Linhares, J.R. Trigo, *Determination of drug levels and the effect of diazepam on the growth of necrophagous flies of forensic importance in southeastern Brazil*, "Forensic *Science International*" 2001, Vol. 120, pp. 140-144; L. Goff, *Early post-mortem changes and stages of decomposition in exposed cadavers*, "Experimental and Applied Acarology" 2009, Vol. 49, pp. 21-36; C.O'Brien, B. Turner, *Impact of paracetamol on Calliphoravicina larval development*, "*International Journal Legal Medicine*" 2004, Vol. 118, pp. 188-189.

10 B. Greenberg, *Behavior of Postfeeding Larvae of Some Calliphoridae and a Muscid (Diptera)*, "Annals of Entomological Society of America" 1990, Vol. 83, pp. 1210-1214.

11 L. Gomes, W.A. Godoy, C.J. Von Zuben, *A review of postfeeding larval dispersal in blowflies: implications for forensic entomology*, "Naturwissenschaften" 2006, Vol. 93, pp. 207-215.

12 J.L Castner, *General Entomology…*, pp. 17-38.

13 M.L. Goff, *Early post-mortem changes…*, pp. 21-36.

b) predators and parasites of necrophagous species (flies Calliphoridae, Muscidae, Stratiomyidae, beetles Silphidae, Staphylinidae, Histeridae, wasps Vespidae);
c) omnivorous species (wasps Vespidae, ants Formicidae, some beetles) and
d) facultative species (e.g. springtails Collembola, spiders Aranea, myriapods Myriapoda).

Reconstruction of the time of death with the use of entomological methods

The great number of variables having an influence on the time of appearance of first postmortem changes and the rate of decomposition make it impossible to precisely determine the PMI in any of the scientific ways as known currently. It is only possible to estimate the time of death.[14] One of the more useful parameters is environmental factors which, among others, are related to insect activity.[15] A forensic entomologist relies on observation and study of the activity of arthropods found on dead bodies, but also in their vicinity.[16]

The determination of estimated PMI on the basis of necrophagous fauna uses the knowledge of insect development, as well as the stages of necrophage and necrophile succession on the corpse. The first method, defined as the development-based method, relies on the knowledge regarding the length of developmental cycles of respective stages of necrophagous insects, which are characterized by repeatability and predictability. The succession-based method, on the other hand, refers to the pattern of insect colonization of the corpse. Thus, a forensic entomologist determines the time interval between the egg-laying by flies that colonize a corpse first and the recovery of the corpse, and identifies the developmental stage of the species which colonized the corpse last.[17]

For a forensic entomologist, his/her familiarity with local fauna. Many species related to the corpse have wide geographic ranges. An arthropod population found on a corpse may, however, comprise species that are characteristic of a given environment, particularly if a habitat covers a specific geographic area or if the very type of the habitat is specific, e.g. a rainforest or a desert[18]. Therefore, keys for identifying necrophagous insects are prepared for locally occurring fauna. These can be applied within the limits of a given latitude, and hence – the range of respective species. One

14 Ibidem, Item 16.
15 V.J.M. DiMaio, S.E. Dana, *Handbook of Forensic Pathology*, 2nd edition, Boca Raton 2006.
16 Ibidem, Item 15.
17 D. Gennard, *Forensic Entomology: An Introduction*, West Sussex 2012.
18 M.L. Goff, *Estimation of postmortem interval using arthropod development and successional patterns*, "Forensic Science Review" 1993, Vol. 5, pp. 81-94.

of the most frequently used keys is the one worked out by Smith (1986), including hints for the identification of insects of the orders Diptera, Coleoptera, Lepidoptera, Hymenoptera and others, occurring in Europe. More detailed keys allow for distinguishing species belonging to one family.

Identification on the basis of morphological characteristics is difficult, especially in case of early developmental stages (eggs, larval stages). In order to identify eggs of necrophagous insects, morphometric tests are carried out with the use of modern techniques, such as scanning electron microscopy (SEM).[19] Classical methods are still applied, too, i.e. egg culture in controlled conditions until hatching into larvae, whereafter these are identified.

OIN case of larvae, the first activity aiming to identify the species is defining which stage the larva is at. The particular larval stages are distinguished based on the number of slots in each posterior spiracle on the last abdominal segment. However, as Gennard maintains,[20] the size is not a very reliable factor due to the influence of the type of food on the development and length of larvae.

An essential criterion for the identification of a species are the characteristics of the cephalopharyngeal skeleton at the first larval stage (the 1st instar), or the details of the spines of the segmental bands and the structure of the anterior spiracle at the third larval stage (the 3rd instar).[21] The specific classification of larvae is, however, very difficult and requires the expertise of a highly qualified specialist in this field. Unfortunately, since the 1990s the number of experts has been falling continuously.[22] Therefore, in recent years there has been a turn towards molecular testing. Thanks to the development of appropriate analysis protocols based on universal genetic markers, it is possible, in a short space of time, to mark larva species feeding on a corpse. In practice, mixed protocols are often used for greater certainty, that is the classical identification method relying on morphological characteristics and molecular methods with the use of genetic markers.

19 P.M. Mendonça, J.R. dos Santos-Mallet, R.P. de Mello, L. Gomes, M.M. de Carvalho Queiroz, *Identification of fly eggs using scanning electron microscopy for forensic investigations*, "Micron" 2008, Vol. 39, pp. 802-807.

20 D. Gennard, *Forensic Entomology: An Introduction*, 1st edition, West Sussex 2012.

21 Y.Z. Erzinçlioğlu, *Immature stages of British Calliphora and Cynomya, with a re-evaluation of the taxonomic characters of larval Calliphoridae (Diptera)*, "Journal of Natural History" 1985, No 19, pp. 69-96.

22 M. Benecke, *Arthropods and Corpses*, in: M. Tsokos (ed.), *Forensic Pathology Reviews*, Vol. 2, New York 2004, pp. 207-240.

DNA analysis as an alternative to classical methods of forensic entomology

Molecular identification is based mostly on analyses of mitochondrial DNA (mtDNA). The application of the mitochondrial genome for species identification has a lot of advantages. First of all, it is the use of universal starters to amplify conserved genes for large groups of organisms. It is also important that mtDNA is much more resistant to degradation under the influence of environmental factors than nuclear DNA, and there is much more of it in cells than nDNA. As a consequence, it is possible to obtain results from a small amount of input material, even highly degraded.

So far, researchers have managed to select many genetic markers that provide the opportunity to be applied in the identification of necrophagous fly species. Used are, first of all, genes coding for cytochrome oxidase subunits I and II (COI and COII),[23] cytochrome b,[24] ND4 and ND4L,[25] ND5,[26] or 16S rDNA. [27] The identification of necrophagous beetles is a subject that is taken up less often by researchers, as demonstrated by the number of publications. Among markers used for molecular typing of beetle species is, first of all, the COI gene[28] and the fragment including the sequence of the COI and COII genes.[29]

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23 F. Alessandrini, M. Mazzanti, V. Onofri, C. Turchi, A. Tagliabracci, *MtDNA analysis for genetic identification of forensically important insects*, "Forensic Science International: Genetics Supplement Series" 2008, Vol. 1, pp. 584–585; M.L. Harvey, S. Gaudieri, M.H. Villet, I.R. Dadour, *A global study of forensically significant calliphorids: implications for identification*, "Forensic Science International" 2008, Vol. 177, pp. 66-76; J.F. Wallman, R. Leys, K. Hogendoorn, *Molecular systematics of Australian carrion-breeding blowflies (Diptera: Calliphoridae) based on mitochondrial DNA*, "Invertebrate Systematics" 2005, Vol. 19, pp. 1-15.

24 M. Gil Arriortua, M.I. Salona Bordas, L.M. Cainé, F. Pinheiro, M.M. de Pancorbo, *Cytochrome b as a useful tool for the identification of blowflies of forensic interest (Diptera, Calliphoridae)*, "Forensic Science International" 2013, Vol. 228, pp. 132-136; M. Gil Arriortua, M.I. Saloña-Bordas, L.M. Cainé, F. Pinheiro, M.M. de Pancorbo, *Mitochondrial and nuclear DNA approaches for reliable identification of Lucilia (Diptera, Calliphoridae) species of forensic interest from Southern Europe*, "Forensic Science International" 2015, Vol. 257, pp. 393-397.

25 Ibidem, Item 26.

26 R. Zehner, J. Amendt, S. Schütt, J. Sauer, R. Krettek, D. Povolný, *Genetic identification of forensically important flesh flies (Diptera: Sarcophagidae)*, "International Journal Legal Medine" 2004, Vol. 118, pp. 245-247.

27 W. Xinghua, C. Jifeng, G. Yadong, C. Yunfeng, W. Kunlu, L. Qinlai, W. Jiangfeng, Y. Li, L. Lingmei, Z. Ming, W. Xiang, C.Y. Song, L. Yuan, C. Yaoqing, L. Jianbo, Z. Jinguo, X. Peng, *The availability of 16S rDNA gene for identifying forensically important blowflies in China*, "Romanian Journal of Legal Medcine" 2010, Vol. 1, pp. 43-50.

28 M. Sharma, D. Singh, A.K. Sharma, *Mitochondrial DNA based identification of forensically important Indian flesh flies (Diptera: Sarcophagidae)*, "Forensic Science International" 2015, Vol. 247, pp. 1-6.

29 H. Schroeder, H. Klotzbach, S. Elias, C. Augustin, K. Pueschel, *Use of PCR-RFLP for differentiation of calliphorid larvae (Diptera, Calliphoridae) on human corpses*', "Forensic Science International" 2003, Vol. 132, pp. 76-81.

Apart from the conventional PCR and sequencing, researchers may also make use of alternative methods that are equally effective, and their application depends on a researcher's individual approach. A successfully used method is restriction fragment length polymorphism (RFLP), preceded by PCR.[30] The product of PCR is cut by restriction enzymes, giving a species-specific restriction fragment pattern.

New methods are being sought whose application will allow to minimize the time of analysis. One of such methods is HRM PCR (High-Resolution Melting PCR). It is based on measuring the fluorescence of a dye intercalating between double-stranded DNA during the denaturation of the DNA-dye complex.[31] An advantage of this method is the possibility to identify various genetic variants occurring within a species, hence it is recommended for entomological analyses. This method is characterized by high sensitivity, it is quick and does not require much experience from the laboratory assistant.[32]

Forensic entomology is a relatively young science. It has been forgotten for many years, and its dynamic development has fallen on the recent 30 years. Presently, it is more and more often used in police procedures and forensic laboratory practice. However, insects have not "said" their last word yet. More and more necrophagous species are described, new research and testing methods are proposed or existing ones are improved. An important task for the future is to stimulate interest in forensic entomology in countries where it is still a niche discipline and search for new applications of forensic entomology in practice (routine caseworks).

Molecular identification of necrophagous insects – selection of an isolation method, COI and cytB marker testing

One of the most important stages in genetic analyses is the selection of an appropriate isolation method, allowing the obtainment of the biggest possible quantities of high molecular weight DNA, even from a small amount of input material. Most frequently, ready-made commercial kits are used for nucleic acid extraction, whereas in case of more difficult materials classical methods are applied, such as the organic

30 Y. Malgorn, R. Coquoz, *DNA typing for identification of some species of Calliphoridae. An interest in forensic entomology*, "Forensic Science International" 1999, Vol. 102, pp. 111-119; S.T. Ratcliffe, D.W. Webb, R.A. Weinzievr, H.M. Robertson, *PCR-RFLP identification of Diptera (Calliphoridae, Muscidae and Sarcophagidae) – a generally applicable method*, "Journal Forensic Science" 2003, Vol. 48, pp. 783-785; J.A. Smith, N.C. Baker, *Molecular genetic identification of forensically important flies in the UK*, "Forensic Science International: Genetics Supplement Series" 2008, Vol. 1, pp. 620-622.

31 E. Mader, B. Lukas, J. Novak, *A strategy to setup codominant microsatellite analysis for high-resolution-melting-curve-analysis (HRM)*, "BMC Genetics" 2008, Vol. 9, p. 69.

32 T. Malewski, A. Draber-Mońko, J. Pomorski, M. Łoś, W. Bogdanowicz, *Identification of forensically important blowfly species (Diptera: Calliphoridae) by high-resolution melting PCR analysis*, "International Journal of Legal Medicine" 2010, Vol. 124 124, pp. 277-285.

method. Within pilot studies conducted at the University of Szczecin, an attempt was made at comparing the efficiency of these two methods. The column method was carried out with the use of the kit NucleoSpin Tissue, Macherey-Nagel (Germany). In case of the organic method, three modifications were tested: 1) the organic method phenol: chloroform: isoamyl alcohol (25:24:1); 2) the organic method phenol – chloroform with DTT (dithiothreitol) in a digestion buffer; 3) the method CTAB, in the variants: 1 day, 2 days and 3 days of incubation withProteinase K and 2 days without Proteinase K[33]. The isolation methods and their modifications were chosen due to the presence of chitin. This polysaccharide is found in insect crusts and according to some reports may decrease the quality of isolated DNA, especially if only insects cuticles are available. In order to effectively release DNA from chitin, the application is proposed of high concentrations of DTT, Proteinase K and detergents[34].In addition, polysaccharides, including chitin, are considered PCR inhibitors, by disturbing the enzymatic process and imitating nucleic acids[35].

Material collected from the environment, from the so-called "meat" traps, was used for the isolation. Prior to the analyses, the material was stored in temp. -20° C. Fly and beetle larvae were divided in half. One part was used for the isolation, the other was stored frozen (the possibility to repeat the isolation from the same specimen). The insects were prepared for the isolation as ground by means of a mini homogenizer.

The results of electrophoresis in agarose gel (1%, dyed by ethidium bromide), revealed that the amount of the input material (half a larva) is sufficient to obtain a relatively high concentration of DNA in the (Photos 1, 2, 3). In case of adult specimens, smaller amounts of DNA were obtained from beetles than from flies.

The column method proved to be the most effective isolation method, providing the largest amounts of high molecular weight DNA (Photo 3). The isolations with CTAB and their modifications, as well as the isolation by the organic method with DTT, did not differ one from the other as far as the quality of isolates obtained (Photos 1, 2).

33 M. Chen, Yy. Zhu, J. Tao, Y. Luo, *Methodological comparison of DNA extraction from Holcocerrus hippophaecolus (Lepidoptera: Cossidae) for AFLP analysis*, For Study China 2008, Vol. 10, pp. 189-192.

34 P.F. Campos, T.M. Gilbert, *DNA extraction from keratin and chitin*, "Methods in Molecular Biology" 2012, Vol. 840, pp. 43-49.

35 C. Schrader, A. Schielke, L. Ellerbroek, R. Johne, *PCR inhibitors – occurrence, properties and removal*, "Journal of Applied Microbiology" 2012, Vol. 113, pp. 1014-1026.

The quality of the isolates was tested by carrying out a PCR. Fragments of the gene COI[36] and cytB[37] were amplified. All larval and adult specimen isolates, as obtained by each of the methods, were used. In case of the COI gene amplification, the product was obtained only in case of the isolates acquired by the column and organic with DDT methods (Photos 4, 5). No products were obtained in case of the isolates from CTAB (Photo 4). Analogous results were obtained in case of cytB (data not shown). The results demonstrate that both the column method and the one with the application of DTT removed the PCR inhibitors, enabling the acquisition of the amplification products.

Both the quality of the isolates and of the PCR products proved to be the highest in case of the application of the column method, and the reaction efficiency was identical both for COI and cytB. The above results attest to the superiority of the column method over the organic method and its modifications in case of materials being insect larvae and their adult stages. The isolation kit, as applied, proved to be suitable to purify the sample of all contaminants, including chitin as well. In this way, the amplification of mitochondrial genes was made possible. It should, however, be borne in mind that not every DNA isolation commercial kit is equally effective. Prior to a wide scale laboratory application, a column isolation kit should be tested on a small number of samples.

Amplicons for the COI and cytB genes were subjected to sequencing by the enzymatic method, and the sequences were worked out using the Sequencher 5.4.6 software. Afterwards, for the purposes of the species-specific identification of the insects under examination, a BLAST analysis was performed (https://blast.ncbi.nlm.nih.gov/Blast.cgi). The results of such an analysis illustrate not only which of the mitochondrial markers used is a more precise tool for a species-specific identification, but also show the state of saturation of the Gene Bank with this type of sequences.

In case of the cytB sequence, the highest values of matching of the analyzed sequence reached only 89%, in some cases giving nonspecific matches, both to the orders of flies and beetles. The COI gene sequences allowed reaching even 100% of specific matching, both in case of fly samples and beetle ones, whereas the lowest values reached 99,5%. The values, as referred to above, indicate that due to the saturation of the gene base to a small degree, the most efficient marker for the species-specific identification of necrophagous insects is, for the moment, the COI gene fragment.

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36 O. Folmer, M. Black, W. Hoeh, R. Lutz, R. Vrijenhoek, *DNA primers for amplification of mitochondrial cytochrome c oxidase subunit I from diverse metazoan invertebrates*, "Molecular Marine Biology and Biotechnology" 1994, No 3, pp. 294-299.

37 T.J. Merritt, L. Shi, M.C. Chase, M.A. Rex, R.J. Etter, J.M. Quattro, *Universal cytochrome b primers facilitate intraspecific studies in molluscan taxa*, "Molecular Marine Biology and Biotechnology" 1998, No 7, pp. 7-11.

The decreased utility results rather from the insufficient number of records in the Gene Bank. Moreover, a separate base for cytB is lacking, which would verify the quality of sequences being deposited (as, for instance, EMPOP in case of human mtDNA or barcoding). Therefore, it seems advisable to supply gene bases with other marker sequences that will make it possible to work out protocols for insect identification for the purposes of the investigation.

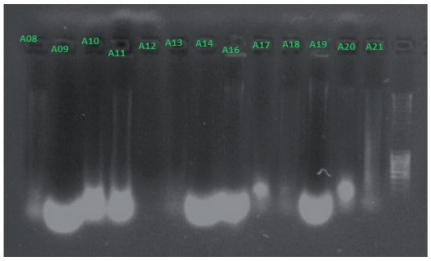

Photo 1. *Electropherogram of isolates obtained by organic method with CTAB. Three-day incubation: A08 – A09 fly larvae; A10 adult beetle, A11 adult fly; Two-day incubation with Proteinase K: A12 – A14 fly larvae, A16 adult fly; Two-day incubation without Proteinase K: A17 – A19 fly larvae, A20 adult beetle, A21 adult fly.*

Source: B. Wąsowicz, M. Ficek.

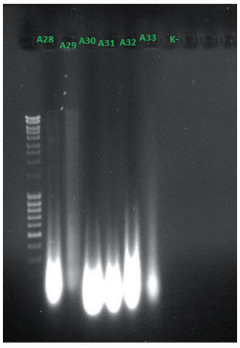

Photo 2. *Electropherogram of isolates obtained by organic method with DTT. A28 – A30 fly larvae, A31 beetle larva, A32 adult beetle, A33 adult fly.*

Source: B. Wąsowicz, M. Ficek.

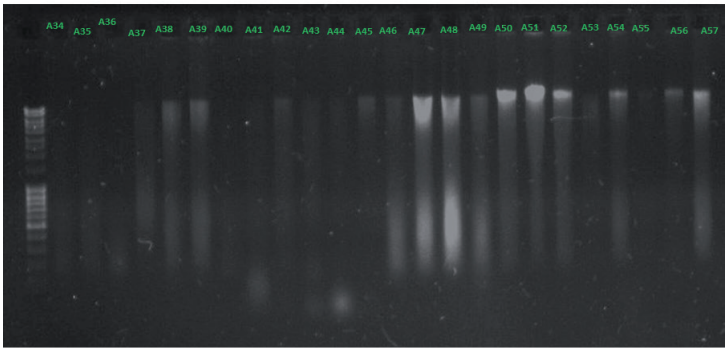

Photo 3. *Electropherogram of isolates obtained by column method. A34, A35, A37 – A39, A41 – A46 beetle, A36, A40 beetle larva, A47 – A57 fly.*

Source: B. Wąsowicz, M. Ficek.

Photo 4. *Electropherogram of products of cox1 amplification. Isolation from CTAB: A01 – A06 fly larva, A05 adult fly, A06 beetle; Isolation from CTAB+ 3 days of incubation: A08 – A09 fly larva, A10 beetle, A11 adult fly; Isolation from CTAB +Proteinase K 2 days of incubation: A12 – A14 fly larva, A16 adult fly; Isolation from CTAB without Proteinase K 2 days of incubation: A17 – A19 fly larva, A20 beetle, A21 adult fly; Column method: A22– A24 fly larva, A25 beetle larva, A26 beetle, A27 adult fly.*

Source: B. Wąsowicz, M. Ficek.

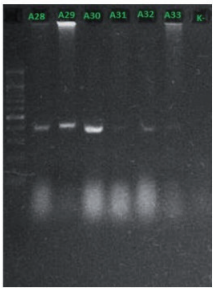

Photo 5. *Electropherogram of products of cytB amplification. Isolation from DTT: A28-A30 fly larvae, A31 beetle larva, A32 adult beetle, A33 adult fly.*

Source: B. Wąsowicz, M. Ficek.

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mtDNA ANALYSES, NEXT-GENERATION SEQUENCING, PHENOTYPIC TESTING IN IDENTIFYING THE DONOR OF A BIOLOGICAL MATERIAL

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This study discusses the application of the newest tool of forensic genetics, next-generation sequencing, in forensic testing. The NGS technology enables parallel testing of millions of DNA fragments – depending on the purpose of the analysis performer, these fragments may carry information on, for instance, the appearance and biogeographical origin of the person who has left his/her trace at a crime scene, or whose remains have been recovered. They can also constitute fragments of mitochondrial DNA which, having been put together by means of bioinformatics tools, will be used to reconstruct the sequence of a complete mtDNA genome. Before our very eyes, the transition takes place of research using NGS from science to routine testing in the field of forensic genetics, which calls for the development of new, international guidelines for its analysis and interpretation.

Introduction

Already since the second half of the 1990s, the golden standard of forensic genetics has been the short tandem repeat fragment analysis, STRs being located in the non-coding part of the nuclear genome, both on autosomal chromosomes and on sex chromosomes. The results of this analysis, although invaluable in case of comparative studies, do not give any hints regarding the appearance of a given person, thus, for lack of indication as to his/her identity, comprising but dry facts. In the meantime, the development of the next-generation sequencing technology, apart from allowing a deeper insight into STR profiling by means of an intimate knowledge of

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the nucleotide sequence of their alleles, enables also testing of SNP-type markers, based on variants that differ one from another by just one nucleotide, on a much larger scale than before. First studies pointing at the possibility of making phenotype predictions and estimating biogeographical origin on the basis of SNP-type markers, appeared as early as in the first decade of the 21st century.[1] The efforts of the scientific milieu, forensic laboratories and biotechnological companies all around the world, as well as the increasingly common use of the NGS method, provided for the development of a range of tools for translating genomic data into information about the appearance and biogeographical origin of a person wanted by law enforcement agencies or human remains recovered at a stage of decomposition that precludes identification. SNP markers, obtained through next-generation sequencing, may also serve to determine a genetic profile for comparative identification tests in a situation when the degree of fragmentation of the material renders it impossible to obtain results within STR systems. The throughput of the NGS technology also enables sequencing of the complete mitochondrial genome, whereas the forensic genetics standard covers from four (the variable regions 1 and 2) to ca. seven percent (control region) of the molecule of human mtDNA.

Next-generation sequencing

In principle, nucleic acid sequencing technologies may be classified into two groups: first-generation sequencing, which includes the generally used Sanger method, and high throughput sequencing where, in turn, one can distinguish second and third-generation sequencing.[2] The FGS and NGS technologies, apart from methodological

1 L. Chaitanya, Breslin K., Zuñiga S., Wirken L., Pośpiech E., Kukla-Bartoszek M., Walsh S., *The HIrisPlex-S system for eye, hair and skin colour prediction from DNA: Introduction and forensic developmental validation*, "Forensic Science International: Genetics" 2018, Vol. 35; Phillips C., Parson W., Lundsberg B., Santos C., Freire-Aradas A., Torres M., Lareu M. V., *Building a forensic ancestry panel from the ground up: The EUROFORGEN Global AIM-SNP set*, "Forensic Science International: Genetics" 2014, Vol. 11(1); Budowle B., Van Daal A., *Forensically relevant SNP classes*, "BioTechniques" 2018, Vol. 44; Draus-Barini J., Walsh S., Pośpiech E., Kupiec T., Głąb H., Branicki W., Kayser M., *Bona fide colour: DNA prediction of human eye and hair colour from ancient and contemporary skeletal remains*, "Investigative Genetics" 2013, Vol. 4(1); Halder I., Shriver M., Thomas M., Fernandez J. R., Frudakis T., *A panel of ancestry informative markers for estimating individual biogeographical ancestry and admixture from four continents: Utility and applications*, "Human Mutation" 2008, Vol. 29(5); Kayser M., Schneider P.M., *DNA-based prediction of human externally visible characteristics in forensics: Motivations, scientific challenges, and ethical considerations*, "Forensic Science International: Genetics" 2009, Vol. 3(3); Kidd J.R., Friedlaender F.R., Speed W.C., Pakstis A.J., De La Vega F.M., Kidd K.K., *Analyses of a set of 128 ancestry informative single -nucleotide polymorphisms in a global set of 119 population samples*, "Investigative Genetics" 2011, Vol. 2(1).

2 J.M. Churko, Mantalas G.L., Snyder M.P., Wu J.C., *Overview of high throughput sequencing technologies to elucidate molecular pathways in cardiovascular diseases*, "Circulation research" 2013, Vol. 112(12), pp. 1613–1623, https://doi.org/10.1161/CIRCRESAHA.113.300939.

differences, are also distinct from each other in terms of a significant reduction of the costs of sequencing the human genome, by several dozen thousand times – the Human Genome Project, performed with the use of Sanger technology, absorbed 2.7 billion US dollars, whereas the cost of such research is currently estimated at around USD 1,000.[3] Although every NGS platform has its individual solutions, the principle of the method in each of these cases is based on simultaneous sequencing of thousands, or even millions of DNA fragments.[4]

Analyses using the NGS technology in forensic testing

Analysis of SNP-type markers

The development of high throughput methods of sequencing DNA enabled wide-ranging research of unprecedented proportions. Thanks to the gigantic MPS throughput, it is possible to do research for allelic versions of specific loci occurring with greater frequency in persons suffering from a given disease.[5] The application of GWAS (Genome-Wide Association Study), however, goes beyond medical genetic studies – for it is possible to make a similar linkage of a variant of the SNP marker to the phenotypic traits of a person under analysis (piSNP), or his/her biogeographical origin (aiSNP).[6]

Prediction of phenotypic traits

The estimation of the appearance of a person whose remains were recovered was limited for centuries to an analysis of anthropometric traits, to the exclusion of the shameful period of typological studies.[7] The newest tool of forensic genetics – FDP – however, allows us to estimate an increasing number of appearance features on the basis of an analysis of DNA left at the incident scene or, in case of identification

3 Børsting C., Morling N., *Forensic Science International: Genetics next generation sequencing and its applications in forensic genetics*, "Forensic Science International: Genetics" 2015, Vol. 18, pp. 78-89.

4 Bruijns B., Tiggelaar R., Gardeniers H., *Massively parallel sequencing techniques for forensics: A review*, "Electrophoresis" 2018, Vol. 39(21).

5 Duncan E.L., Brown M.A., *Genome-wide Association Studies*, in: R. Thakker, M. Whyte, *Genetics of Bone Biology and Skeletal Disease*, Amsterdam 2017.

6 Goddard M.E., Kemper K.E., MacLeod I.M., Chamberlain A.J., Hayes B.J., *Genetics of complex traits: Prediction of phenotype, identification of causal polymorphisms and genetic architecture. Proceedings of the Royal Society B*, "Biological Sciences" 2016, Vol. 283, p. 1835; Yilmaz S., Tastan O., Cicek A.E., *SPADIS: An Algorithm for Selecting Predictive and Diverse SNPs in GWAS*, "BioRxiv" 2018 (i), p. 256677.

7 Bednarek J., Rogalla U., Grzybowski T., *Pułapka typologii antropologicznej*, "Archiwum Medycyny Sądowej i Kryminologii" 2009, Vol. LIX.

testing, obtained from recovered human remains.[8] The present state-of-the-art with respect to FDP allows prediction of such appearance features as: eye and hair colour (including its hue),[9] skin colour,[10] premature balding,[11] scalp hair shape[12] and its greying,[13] some features of face morphology,[14] presence of freckles[15] or hight of the body.[16]

Estimation of biogeographical origin

Prior to the NGS era, bio-origin estimation could rely on two types of methods: haplogrouping and SNP marker analysis, to such an extent as allowed by the then technology (in total 34 aiSNPs and 46 insertion/deletion markers). Whole-genome databases, as published, created thanks to results obtained by means of high throughput sequencing, provided for the construction of a new biogeographical origin estimation model. Presently available commercial aiSNP analysis kits contain markers of high capacity to differentiate populations from one another, selected in a way so that the value of the estimation should be close to any of the groups taken into consideration: Africans, Europeans, Asians, (to be understood as pertaining to East Asia),

8 de Cerqueira C.C.S., Ramallo V., Hunemeier T., Azevedo S. de, Sanchez M.Q., *Predicting Physical Features and Diseases by DNA Analysis: Current Advances and Future Challenges'*, "Journal of Forensic Research" 2016, Vol. 7(4).

9 Walsh S., Chaitanya L., Clarisse L., Wirken L., Draus-Barini J., Kovatsi L., Kayser M., *Developmental validation of the HIrisPlex system: DNA-based eye and hair colour prediction for forensic and anthropological usage*, "Forensic Science International: Genetics" 2014, Vol. 9(1).

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11 Hagenaars S.P., Hill W.D., Harris S.E., Ritchie S.J., Davies G., Liewald D.C., Marioni R.E., *Genetic prediction of male pattern baldness*, "PLoS Genetics" 2017, Vol. 13(2).

12 Pośpiech, E., Chen, Y., Kukla-Bartoszek, M., Breslin, K., Aliferi, A., Andersen, J. D., Kayser, M., *Towards broadening Forensic DNA Phenotyping beyond pigmentation: Improving the prediction of head hair shape from DNA*, "Forensic Science International: Genetics" 2018, Vol. 37 (February), pp. 241–251.

13 Pośpiech E., Kukla-Bartoszek M., Karłowska-Pik J., Zieliński P., Woźniak A., Boroń M., Dąbrowski M., Zubańska M., Jarosz A., Grzybowski T., Płoski R., Spólnicka M., Branicki W., *Exploring the possibility of predicting human head hair greying from DNA using whole-exome and targeted NGS data*, "BMC Genomics" 2020, Vol. 21(1).

14 Shaffer J.R., Orlova E., Lee M.K., Leslie E.J., Raffensperger Z.D., Heike C.L., Weinberg S.M., *Genome-Wide Association Study Reveals Multiple Loci Influencing Normal Human Facial Morphology*, "PLoS Genetics" 2016, Vol.12(8).

15 Kukla-Bartoszek M., Pośpiech E., Woźniak A., Boroń M, Karłowska-Pik J., Teisseyre P., Zubańska M., Bronikowska A., Grzybowski T., Płoski R., Spólnicka M., Branicki W., *DNA-based predictive models for the presence of freckles*, "Forensic Science International: Genetics" 2019, No 42, pp. 252-259.

16 Liu F., Zhong K., Jing X., Uitterlinden A., Emile A., Hendriks J., Stenvert L., Drop S., Kayser M., *Update on the predictability of tall stature from DNA markers in Europeans*, "Forensic Science International: Genetics" 2019, Vol. 42.

native Americans and indigenous peoples of Oceania.[17] In present, it is also possible to analyse an "admixture" of the origin which takes account of the complexity of the population of respective parts of continents.[18] aiSNPmarkers are also characterized by a good degree of amplification in degraded.[19]

SNP identification markers

A bigger number and dispersal in the human genome of SNP markers, as compared to STR, in combination with a lower degree of their mutativeness and use of short amplicons in the analysis, contributed to the working on the application of these markers also for the purposes of confirmation or rejection of the thesis of NN human remains' identity.[20] Due to the biallelic character of these loci, the number of markers that should be examined in order to achieve a genotype frequency as comparable to the one obtained from aSTR tests is significantly higher. Kits intended for genetic identification testing contain at present around 100 SNP-type markers. The results of tests using iiSNPmarkers allow to reach the RMP value at a level of 2.8×10^{-51}.[21]

STR marker analyses

A standard analysis of STR-type markers in forensic genetics brings the length of their alleles as characteristic for a given person. Thanks to the sequencing of these markers, it is possible, however, to read their structure, nucleotide by nucleotide, which, in turn, enables detection of the polymorphism of a single nucleotide within an STR marker. The newest tools also allow us to read the sequences of the so-called flanking regions, located between the place binding the starter and the repetitive region of the marker.[22] Although fragment length analysis is, and most probably will

17 Phillips C., Parson W., Lundsberg B., Santos C., Freire-Aradas A., Torres M., Lareu M.V., *Building a forensic ancestry panel from the ground up: The EUROFORGEN Global AIM-SNP set*, "Forensic Science International: Genetics" 2014, Vol. 11(1).

18 Kidd J.R., Friedlaender F.R., Speed W.C., Pakstis A.J., De La Vega F.M., Kidd K.K., *Analyses of a set of 128 ancestry informative single -nucleotide polymorphisms in a global set of 119 population samples*, "Investigative Genetics" 2011, Vol. 2(1); Diepenbroek M., Bayer B., Schwender K., Schiller R., Lim J., Lagacé R., Anslinger K., *Evaluation of the Ion AmpliSeq™ PhenoTrivium Panel: MPS-Based Assay for Ancestry and Phenotype Predictions Challenged by Casework Samples*, "Genes" 2020, No 11(12).

19 Hwa H., Wu M., Lin C., Hsieh W.H., Yin H., Lee T., Lee J.C., *A single nucleotide polymorphism panel for individual identification and ancestry assignment in Caucasians and four East and Southeast Asian populations using a machine learning classifier*, "Forensic Science, Medicine, and Pathology" 2019, Vol. 15(1).

20 Huang, E. Liu C., Zheng J., Han X., Du W., Huang Y., Liu C., *Genome-wide screen for universal individual identification SNPs based on the HapMap and 1000 genomes databases*, "Scientific Reports" 2018 Vol. 8(1).

21 Grandell I., Samara R., Tillmar A.O., *A SNP panel for identity and kinship testing using massive parallel sequencing*, "International Journal of Legal Medicine" 2016, Vol. 130(4).

22 Peng D., Zhang Y., Ren H., Li H., Li R., Sheng X., Wang N., Huang E., Wu R., Sun H., *Identification of sequence polymorphisms at 58 STRs and 94 iiSNPs in a Tibetan population using massively parallel sequencing*, "Scientific Reports" 2020, Vol. 10, p. 12225.

be, a tool allowing answers to questions asked to an expert witness by the ordering body, getting to know the complete sequence of a given marker may constitute an additional means, for instance in case of mixture analyses.[23] Taking account, in global databases, of the incidence of the alleles of the polymorphism of a single nucleotide occurring within STR markers, will also translate itself into lower RMP values, s obtained, which is desirable in case of personal identification and examination of material evidence.

In April 2019, a supplement came out to the guidelines of the Scientific Working Group on DNA Analysis Methods, regarding data interpretation as regards autosomal STR markers[24] for forensic genetics laboratories, including the application of next-generation sequencing in this respect. From the practical point of view, one of the most important issues seems to be software validation within the scope of the concordance of results as reported by it the results obtained from the same sample by means of capillary electrophoresis or other sequencing platforms. This point may raise some doubts, for there is a possibility of obtaining two results differing from each other (although to a small degree and extent, mostly by one repetition more or few in a given locus) with the application of two different multiplex kits dedicated to performing analyses by the capillary electrophoresis method alone, due to different starters used in them by biotechnological companies.[25] Information on a locus under analysis, apart from its commonly used name, should, in case of reporting on the basis of NGS results, contain the range of nucleotide positions as included in the system under analysis, together with the link to the reference sequence of human genome to have been applied. A natural consequence of this principle is its application also to the alleles themselves, as defined within the limits of given loci. Reporting these may, however, be based, depending on the laboratory's internal arrangements, exclusively on the numeric value of a relevant allele, similarly to data obtained by means of capillary electrophoresis, or, additionally, its sequence as well. In case of such an extension of the information contained in the opinion, it is, in turn, necessary to provide the scope of the sequence being reported because of any differences in amplicons obtained with the application of various multiplex kits. In order to ensure comparability of results obtained by means of NGS and CE, the allele number

23 Ragazzo M., Carboni S., Caputo V., Buttini C., Manzo L., Errichiello V., Puleri G., Giardina E., *Interpreting Mixture Profiles: Comparison between Precision ID GlobalFiler™ NGS STR Panel v2 and Traditional Methods*, "Genes" 2020, Vol. 11(6).

24 Scientific Working Group on DNA Analysis Methods, *Addendum to "SWGDAM Interpretation Guidelines for Autosomal STR Typing by Forensic DNA Testing Laboratories" to Address Next Generation Sequencing*, 2019.

25 Westen A.A., Kraaijenbrink T., Robles de Medina E., Harteveld J., Willemse P., Zuniga S., van der Gaag K., Weiler N., Warnaar J., Kayser M., Sijen T., de Knijff P., *Comparing six commercial autosomal STR kits in a large Dutch population sample*, "Forensic Science International: Genetics" 2014, Vol. 10.

reported should not be based on the number of tandem repetitions, but on its length, measured in base pairs. Optionally, on the basis of results obtained, it is possible to assign, additionally, an allele to its numerical value based on the sequence structure, both within the repetitive region and within the flanking one. In case only the numerical value of the allele is provided, a method of reporting isometric alleles must be determined. An important problem to be taken into account by the laboratory is, in addition, the possibility that a situation will occur when the alleles to have been defined by means of the sequence length are not identical with the alleles defined on the basis of the structure of this sequence, because of, for example, the occurrence of insertions or deletions in the flanking region, affecting the final length of the sequence. One should also consider the method of naming alleles of an incomplete number of tandem repetitions, so far names in a descriptive manner.[26]

Analysis of mitochondrial DNA

Human mitochondrial DNA of the total length of 16,569 bp, contains in its structure a noncoding control region in which, in turn, hypervariable fragments can be distinguished of a higher degree of polymorphism: HV1 (including nucleotide positions 16,024-16,365 with respect to the chain L), HV2 (73-340) and a less frequently examined fragment HV3 (438-574).[27] Mitochondrial DNA, as a cytoplasmic genome, is passed on exclusively through the maternal line, which means that the mother passes on her haplotype both to her daughters and sons.[28] The record of the result of a mitochondrial DNA test is a list of nucleotide positions in which a difference was reported with respect to the reference sequence (rCRS – revised Cambridge Reference Sequence), also known as Anderson sequence, after one of the authors of the first publication describing the sequence of the mitochondrial genome.[29] An essential element of the result is also the record of the tested sequence range: because an exemplary result G16129A C16223T (which means that the person under examination had other bases in the nucleotide positions 16,129 and 16,223 than ones expressed in the reference, in this case, respectively: A instead of G and T instead of

26 Scientific Working Group on DNA Analysis Methods, *Addendum to "SWGDAM Interpretation Guidelines for Autosomal STR Typing by Forensic DNA Testing* Laboratories to *Address Next Generation Sequencing*, 2019.

27 Westen A.A., Kraaijenbrink T., Robles de Medina E., Harteveld J., Willemse P., Zuniga S., van der Gaag K., Weiler N., Warnaar J., Kayser M., Sijen T., de Knijff P., *Comparing six commercial autosomal STR kits in a large Dutch population sample*, "Forensic Science International: Genetics" 2014, Vol. 10.

28 Branicki W., Kupiec T., Wolańska-Nowak P., *Badania DNA do celów sądowych*, Kraków 2008.

29 Butler J.M., *Fundamentals of forensic DNA typing*, Amsterdam 2009, pp. 375-388.

C) will have a different value if only the scope HV1 was tested, and a different one if the mutations listed were the only ones within both HV1 and HV2.[30]

mtDNA testing has been applied to forensic genetics also due to the possibility of obtaining results of its analysis in a material in which the determination of the STR profile is precluded due to an increased degree of DNA degradation. The number of mitochondria in a single cell, estimated at dozens or even hundreds, having from four to 10 copies of mtDNA in each of them, as well as the circular structure of mtDNA[31] bring about that its sequencing is sometimes the only chance to determine any genetic profile from the remains under examination.[32] One should, however, bear in mind that the mitochondrial DNA haplotype is not specific for a given person, but his/her entire maternal line. Alike in the case of genetic profiling of the Y chromosome in males, the identical haplotype does not constitute evidence enabling personal identification of both the remains and the person who has left his/her trace at the incident scene.

The high throughput of the NGS technology, enabled significant popularization of testing complete mitochondrial genomes, which already make up for 4,289 out of 8,572 sequences deposited at the EMPOP (the EDNAP Mitochondrial DNA Population Database) database (v4/R13, status as of June 2021).[33] The strategy assumed in such analyses reminds a little the sequencing of mitochondrial DNA fragments, as used co far: the target sequence, which, in this case, is comprised by the entire scope of mtDNA, is divided into shorter sections, which are afterwards matched to the reference by a computer programme. The possibility to analyze a considerable number of amplicons causes that complete sequences of the mitochondrial genome, as divided into 162 fragments, are obtained even from such a low-array material as hair shafts.[34]

Conclusion

Biogeographical origin estimation and phenotype prediction are not classified and classical tools of forensic genetics, neither do they allow the identification *sensu*

30 Parson W., Gusmão L., Hares D.R., Irwin J.A., Mayr W.R., Morling N., Parsons T.J., *DNA Commission of the International Society for Forensic Genetics: Revised and extended guidelines for mitochondrial DNA typing*, "Forensic Science International: Genetics" 2014, Vol. 13.

31 Taanman J.-W., *The mitochondrial genome: structure, transcription, translation and replication*, "Biochemica et Biophysica Acta – Bioenergetics" 2019.

32 Goodwin S., McPherson J.D., Mccombie W.R., *Coming of age: ten years of next- generation sequencing technologies*, "Nature Publishing Group" 2016, Vol. 17(6).

33 EmPOPmtDNA database v4/R13. (2010-2021). Website: www.empop.online, [access: June 1 2021].

34 Chaitanya L., Ralf A., van Oven M., Kupiec T., Chang J., Lagacé R., Kayser M., *Simultaneous Whole Mitochondrial Genome Sequencing with Short Overlapping Amplicons Suitable for Degraded DNA Using the Ion Torrent Personal Genome Machine*, "Human Mutation" 2015.

stricto of a tested person. Potentially, however, they provide a helpful screening technique, limiting the circle of suspects, missing persons to whom given remains may have belonged, or point at a milieu or institution to whom it is worth applying for help in the determination of the identity of the person whose profile has been obtained in the course of the tests. Similarly, mtDNA analysis, although it cannot lead to personal identification on its own, still it serves to verify hypotheses adopted by the investigators.

Forensic genetics has undergone, is undergoing and will undergo changes under the influence of the immensity of data coming from the increasingly numerous test based on the NGS technology. Such a major technological leap calls for creating new regulations, both methodological and legal ones, that will enable the application of NGS fruits in laboratories' routine work worldwide.

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INTERDISCIPLINARY DIMENSION OF FORENSIC IDENTIFICATION IN CROSS-BORDER PROSECUTION – SUMMARY OF RESEARCH RESULTS

INTERDISCIPLINARY DIMENSION OF FORENSIC IDENTIFICATION IN CROSS-BORDER PROSECUTION – SUMMARY OF RESEARCH RESULTS

ŁUKASZ POHL, BARBARA JANUSZ-POHL

The analyses presented in this monograph in the scope of forensic identification as carried out in cross-border criminal proceedings on the basis of biological testing, when considered jointly, make up an elaboration of a *par excellence* interdisciplinary character. It is so since the said monograph provides an insight into the issue in question from the perspective of three mutually complementary points of view: 1) juridical, taking account of not only the national plane, for being indicative, in places, of an essential comparative perspective, 2) organizational and managerial, and 3) *stricte* forensic, relating primarily to the area of biological analyses, particularly in the field of genetics.

The work comprises eleven subject-related studies and a short introduction, describing a project crowned by this publication – an undertaking devoted to the issue of combating terrorism-related cross-border crime through forensic laboratories' joint efforts. The studies contained in the monograph concern – as already mentioned – various aspects of the issue. This circumstance has determined the structure of the book which, eventually, has been framed into six sections, enabling a clear exposition of meticulous research hypotheses and detailed research conclusions, as obtained in the course of the verification of the same.

The first section describes the organizational and financial aspects of European projects. One chapter is found in it – by Marek Jasztal, entitled *European projects as a tool to support police activities – a supervisory approach*, in which the Author outlines the complexity of obligations resting on the Police as the key uniformed service in Poland – a service of universal competence in the scope of public security, competence – let us emphasize this again – that extends far beyond criminal prosecution. Although the basicsource of finance for this service isbudgetary means, supplementary financing – in the Author's opinion – is not insignificant, either, especially as

acquired in the form of European grants and funds. It is, after all, this kind of funding, an Interreg grant, that the researchers used in the project to have resulted in this monograph. The extra-budgetary financing undoubtedly allows the Police to intensify operations in a number of different and weighty areas of their jurisdictional; activity, to name, by way of example, the development of the operational and technical infrastructure, modernization of laboratories, conduct of training activities or creation and functioning of platforms of cooperation between research units and law enforcement agencies.

Section Two, entitled *The legal system of Poland and Germany*, has been devised to systematize general juridical issues related to the specific character of the Polish and German models of criminal prosecution. The key assumptions of the criminal procedure in Poland and Germany have been presented in this section.

In its first chapter, authored by Barbara Janusz-Pohl and entitled *The model of the Polish criminal procedure. An analysis from the perspective of its structure and the form of process functions and procedural guarantees*, basic elements have been presented allowing a description of the Polish criminal procedure, i.e. its two-stage structure, and with respect to the individual stages – the key principles of the procedure, the status of the participants in the proceedings and the scope of their authority. Specifically, the formula has been described here of the relevant stages, with particular emphasis on the initiation and conclusion of the same, as well as the degree of formalization. As has been underlined in this study, the stadiality of the Polish criminal procedure brings the Polish model to the German model in the sense that any errors occurring at the initial stages are of relatively little significance to the final decision. An exception in this respect isunrepeatable evidentiary proceedings that may include evidence from forensic identification. The study in question also draws attention to the developmental trends of the Polish criminal procedure, demonstrating themselves either in the modification of the status of the aggrieved party or within the framework of the approach toprocedural consensualism, and, finally, in the issue of admissibility of evidence, including the admissibility of the so-called private evidence. The shaping of the model of the criminal procedure is also determined – as has been emphasized in the work – by the conditions of admissibility of proceedings, that is the so-called procedural prerequisites.In addition, the said study exposes the normative framework for the criminal procedure, wherein the key source is statutory law, as expressed in such normative acts as the Code of Criminal Procedure, the Constitution of the Republic of Poland, acts of international law that are binding on Poland, including the European Convention on Human Rights (ECHR). The increasing role has also been underlined ofjudicial decisions – of the Supreme Court, the Constitutional Tribunal, as well as the European courts: The Court of Justice of the European Union (CJEU) and the European Court of Human Rights (ECtHR). The work presented

also notes that the fundamental aspect of the prosecution model in Poland is defined by procedural principles. These have been discussed in several groups and in relationto the respective stages of the procedure. It has been noted that in connection with the initiation of criminal prosecution high importance is attached to the principles of action *ex officio* and legality (in the context of the preparatory proceedings), as well as the principle of complaints (in the context of the jurisdictional stage and its phases). In this context, it has been emphasized that in connection with the principle of legality, as binding, Polish criminal prosecution bodies are obligated to initiate and conduct preparatory proceedings regarding offences prosecuted *ex officio* in case of a reasonable suspicion of an offence, whereas an authorized prosecuting attorney, having acknowledged the validity of a charge, is bound to bring it to court, and, subsequently, support the same in the course of the court proceedings. For a few tears, however – as has been exposed in the paper –regulation has been in force that allows the prosecutor to withdraw a complaint with binding effect for the court; thereby the court can neither initiate legal proceedings nor continue the same without the authorized prosecuting attorney's complaint. The prerequisite for the initiation of court proceedings by means of a complaint of an authorized entity also pertains to control procedures (filing means of appeal and extraordinary means of challenge), as well as incidental proceedings. The Polish model of criminal prosecution – as has been defined in the conclusion of the study – is subjected to evolution and constant modifications. At present, these changes include introducing the aspect of evidence preclusion. Yet, this is still a model in which exceptions to the principle of legality in favour of prosecutorial opportunism (verification of its validity) are few.

In the second chapter of the section under discussion, by Leo Jankowski, entitled *Das Strafverfahren in Deutchland*, there is, in turn, a presentation of the characteristics of the German model of criminal procedure. The study indicates that this model is based on two stages. It also sketches the basis, the objective and temporal scope, and depicts the variety of formulas of the preparatory (prejudicial) proceedings. The issue of the relation of the preparatory proceedings to the court proceedings is also expressed therein, drawing the reader's attention to the significant role of the principle of complaintsin this context. As the Author argued criminal procedure law must do justice to the difficult task of providing prosecuting authorities with the ability and means to prove the guilt of the accused party and thus ensure the protection of society with utmost certainty, while at the same time carefully balancing these interests against the civil liberties of the individual to prevent an innocent person from being wrongfully convicted.

The third chapter of Section Two fits into the framework of theoretical considerations regarding cross-border prosecution, authored by Remigiusz Dobrowolski and entitled *Implementation of means of evidence obtained from process bodies of other*

countries indicating limitations on the admissibility of evidence (both sources of evidence and means of evidence), as obtained by way of cross-border legal aid. This fragment describes – to the extent necessary – basic notions of the law of evidence applied by the Polish legal doctrine. It also points to the polysemy of the notion of evidence and exposes exemplary typologies of inadmissible evidence. It has been emphasized that the admissibility of using evidence obtained by foreign law enforcement agencies is limited. This results from the fact that the conditions for evidence legality differ in various legal systems. Every procedural act is characterized by a defined specific set of rules, wherein the national legislator enjoys the liberty to decide as to the shaping of the same. For this reason, making use of the result of an evidentiary action as performed abroad requires due assessment that consists in determining whether such an action is not inconsistent with the legal order of the Republic of Poland. By way of a complement to the analysis as contained in the discussed chapter, it may be added that the clause of inconsistency with the legal order of the Republic of Poland assumes some margin of deviation from the application of the legal rules as binding in Poland with respect to an act performed abroad, but, simultaneously, the key rules pertaining to a given act according to Polish law, especially ones whose violation implies a particular procedural sanction, must be observed. The very mechanism of taking evidence in cross-border proceedings is based on a relatively complex legal framework. A legal instrument is operative between Member States of the European Union (exceptDenmark and Ireland):the European Investigation Order (EIO), introduced by means of the Directive of the European Parliament and of the Council of 3 April 2014 (No 2014/41/EU), between non-EU states operate multilateral and bilateral international agreements, whereas in the absence of international agreements, an application for legal aid is submitted pursuant to Art. 585 CCP et seq. The flagship instrument of evidence-related cooperation is the so-called European Investigation Order. In the study under discussion, apart from brief characteristics of this means, there is a more detailed presentation of theevidentiary action of appointing an expert witness based on an EIO. Also, examples are discussed, both with respect to the use of this means, as well as letters rogatory – a request for judicial assistance originating in (addressed to) a non-EU state. The research fragment contains quantitative data: statistics of the years 2009-2018 regarding international assistance within the jurisdiction of the Regional Public Prosecutor's Office in Szczecin, with a particular focus on the cooperation with Germany, and qualitative ones from the Author's own practice.

Section Two is completed with a chapter by Mateusz Tomczyk concerning legal conditions of transporting evidential and reference material among countries in the light of regulations in force in the territory of Poland. In it, the author has indicated the legal framework of evidentiary proceedings, including cross-border technical

and executive actions. The key legal instruments here are letters rogatory, as a tool for classical cooperation, and the EIO, as a dominating instrument of cooperation between UE Member States, allowing transfer of sources of evidence, as well as performing detective and extractive evidentiary actions in order to obtain these sources. In addition, the Author has reported on the issue of essential differences in the Polish and German legal systems as regards recovering, securing and transferring – that is the exchange procedure – of evidential materials to have been found at the incident scene (particularly biological traces) and reference materials to have been obtained. The key issue is that incoherent procedures, also in their technical respect (the operational and executive one – due to unsuitable packaging, improper carriage of the material, or because the record or label is missing, as appropriate), may lead to disqualification of such evidential and reference material, resulting in its unusability for forensic analysis in the transferee state. Outside the legal framework providing for the question of the legality of evidence there are, however, issues pertaining to the methodology of evidence collection, regulated by implementing acts in force in Poland, among others Regulation No 10 of the Commander-in-Chief of the Police of 7 May 2015 regarding the procedure of handling forensic materials and the mode of creating and method of keeping forensic collections in forensic laboratories of the Police and Guidelines No 3 of the Commander-in-Chief of the Police of 30 August 2017 regarding the performance of certain investigative activities by police officers. It is on them that the Author has focused his attention, stating that despite the fact that the cross-border procedure for transporting evidential materials and reference materials is regulated in general terms, in his opinion such a state of affairs must be claimed correct, since the variety of evidential material that may be transported requires a diverse approach, whereas adequate best practice standards should be shaped by experts in forensic science.

Section Three also has juridical contents, yet this time they focus on the position of expert witnesses in the Polish and German criminal procedures. Considerations regarding the Polish legal order have been presented by Marta Jasińska in a study entitled *The expert witness in the criminal procedure*. The Author concentrated on the categorization of expert witnesses, including court-appointed expert witnesses and the so-called ad hoc experts. She has analyzed the conditions that a person appointed as an expert witness must fulfil, as well as the relevant procedure of entering the same in the list of expert witnesses. She has also noted that the status of the expert witness in court proceedings is held exclusively by a person to have been appointed in this capacity by means of a decision. Therefore, the so-called private experts or private appraisers are not expert witnesses until they are appointed to fulfil the function by a process body, the time limit for the drawing up of an opinion and its subject matter being specified. Expert witnesses' key rights and obligationshave been characterized,

in particular their procedural position has been described as sources of evidence that are distinguished by elevated presumption of credibility, as entities covered by the principle of objectivism. Diverse formulas of expert witnesses' submissions have been emphasized, i.e. giving an oral opinion as well as a written one, the question has also been marked of expert witnesses' access to court case files. Expert witnesses' opinions are valued on the plane of their clarity, wholeness, consistency, as well as resoluteness/irresoluteness and reliability. As far as the last aspect, the Author has drawn attention to the question of selection of candidate experts and the relatively simplified procedure of entering the same in the list of expert witnesses, arguing that the fulfilment of the formal requirements is not the guarantee of the possession of actual competencies, especially appropriate practical preparation of candidate experts, whereas the existing procedures do not enable adequate selection of the same. Based on the observations as contained in the article, one may state that expert witnesses' opinions are, alike other means of evidence, subject to free evaluation of evidence. Thus, although experts bring important substantive elements into the case, they cannot replace determining authorities by making assessments, particularly ones that are relevant as far as criminal law is concerned. Still, it is beyond doubt that for a determining authority (the criminal court) to be able to apply the principle of free evaluation of evidence with respect to scientific evidence, based on knowledge, experience and logical reasoning, it must be prepared to do it properly. The formula of expert witness geneticists, microbiologists and entomologists' opinions, as essential for this monograph, implies that the adjudicating authorities should be properly prepared. Such a conclusion arises univocally from the next papers included in this monograph. Using the so-called bridging sciences in forensics and their contribution to the effectiveness of criminal prosecution calls for constant updating of knowledge by the adjudicating authorities.

The second chapter of Section Three is authored by Mirko Faber and devoted to the status of the expert witness in the German criminal procedure on the example of the DNA test opinion in Germany – *DNA Analysen in Deutschland – rechtliche AspekteStrafverfahren und DNA-AnalysenimÜberblick: Voraussetzungen, Grenzen und Möglichkeite*. This fragment described specific legal conditions of genetic opinions in the German system. Starting with general issues connected with the appointment of expert witnesses in criminal proceedings, that is with a discussion of the normative foundations and possible variants of experts' participation, the focus has been put on specific elements of opinions from genetic testing. The article takes account of the characteristics of evidentiary actions aiming to obtain test and comparative material. The Author noted that the importance of molecular and genetic screening pursuant to sections 81e et seqq. CCP for criminal proceedings in Germany has increased significantly in recent years. Advancing technical and scientific findings mean that ever

smaller amounts of genetic material are sufficient for tests to match against reference samples. At the same time, the accuracy of the results has increased immensely. However, the prosecuting authorities are also responsible for ensuring an effective and targeted use of this type of expert evidence based on their experience gained and with constant attention to the principle of proportionality. By continuously adapting the underlying statutory authorisations, the legislator ensures that DNA screening can match scientific progress while ensuring legal certainty. In this connection, both efforts to elaborate practice-oriented statutory authorisations and the limitation of what is legally permissible to that part of scientific feasibility that is justifiable in terms of fundamental rights are clearly discernible. It remains to be seen in which direction the discussion on lowering the formal requirements for the current powers of intervention will develop. An important factor in these considerations will certainly be the degree of scientific progress in the context of molecular and genetic screening and the resulting new – at present perhaps not even conceivable – perspectives for use in criminal prosecution and prevention.

In the fourth section, wherein the subject matter of scientific exploration is the issue of forensic identification, there is one chapter written by Wojciech Achrem, titled *Forensic identification on the basis of an expert witness's opinion from genetic testing*. The degree of technological development of test methods based on biometric traits (fingerprints, physical characteristics of the voice and linguistic ones of the speech, as well as genetic polymorphism) allows to perform forensic identification, that is to establish the identity of persons suspected of committing a crime on the basis of specified anthropometric measurements. The Author has drawn the reader's attention to numerous nuances related to the interpretation of an expert witness's opinion regarding forensic identification, as well as major identification formulas, it is individual, group and negative ones. And so, he emphasized, among others, that one of such dilemmas pertains to the interpretation of the phrases "the same" and "the same kind of arrangement of polymorphic traits", and he also pointed tothe problematicity of the statement that "the deoxyribonucleic acid profiles of the evidential and reference materials are identical" (for this statement – as the Author emphasizes – is misleading for recipients of the opinion; genetic trait concordance does not mean sameness, but proves that the applied testing procedure does not allow to state the occurrence of natural differences). As the discussed paper underlines, a genetic testing expert witness does not solve, in his/her opinion, the problem of whether the DNA profile of the evidential and reference materials is a unique one or not, but onlywhether there is sufficient proof to state that the concordance of the tests-results attests to a possibility that the biological material originates from one person. If the answer to the question so posed is the positive one, then it is assumed that the individual identification has been achieved on the basis of the analysis of

genetic polymorphism. Individual identification is invariably linked to a discussion on the method of classifying an expert witness's opinion conclusions into the group of personal identifiers in connection with the need to assess the uncertainty of test results. In this aspect, it is indicated that the existing dilemma regarding the minimal value of mathematical parameters so that the statement is validated that individual identification has been achieved, should be resolved on the basis of population data. In the author's opinion, the parameter for the chance of a repetition of variable genetic traits in the population must assume a higher value than the estimated number of people who have populated the planet since the beginning of the species. If the result of calculations of the probability regarding the hypothesis stating that the biological material originates from the person from whom the reference material has been collected, exceeds this limit, then the expert witness has the ground to state that he/she has achieved individual identification. While describing the types of forensic identification, the formula of "DNA fingerprinting" has also been presented, which should unequivocally be distinguished from a dactyloscopic examination, characterized by a completely different methodology, what is more, it is not adequate for personal identification on the basis of DNA polymorphic traits. On the other hand, a number of interpretative issues are connected with the so-called group identification, consisting in the examination and ascertainment of the affiliation of a questioned object to a certain set of objects, the purpose of which, therefore, is to state that a specific trace has the same features as the reference material. The considerations are enriched by being set against an empirical analysis comprising an exemplification of the presented forms of forensic identification. One of the key findings contained in this study is that adequate establishment of the type of a genetic opinion, that is whether it is an opinion regarding individual, group or negative identification, determines directly the definition of theprobative value of an expert witness's conclusions. These conclusions, having linked the same correctly to the type of the opinion, may not correspond to the exaggerated expectations of participants in court proceedings as to their resolution and applicability to the establishment of facts.

In the fifth section, devoted to the quality of forensic testing, there is a chapter by Ireneusz Sołtyszewski titled *Management systems in court laboratories*. The Author has discussed in detail the issue of accreditation of court laboratories, as indispensable to obtain the certificate of accreditation of the Polish Centre for Accreditation (PCA) for compliance with the standard PN-EN ISO/IEC 17025, and then necessary for the maintenance of an implemented management system and improvement of the same, pointing, at the same time, that the obtainment of a certificate of accreditation does not determine univocally that the laboratory and the procedures, as applied, operate properly; hence – in his opinion – the fundamental importance of a continual process of improving the management system, particular emphasis being

placed on audit activities and management reviews. An analysis is provided of the standard PN-EN ISO/IEC 17025, which is universal in nature, i.e. refers to every laboratory, irrespective of its size, methods used for testing, and structure i.e. whether the laboratory is an independent entity or whether it is a part of a larger structure. Simultaneously, all test methods and procedures should be documented, providing the source of their origin (manuals, guidelines, standards, validated own methods, literature). Laboratories may also apply their own test methods if they are suitable for the intended application and have been validated priorly. Moreover, laboratories are obligated to keep detailed records of received results, the procedure used for validation, and statements if a given methodology is adequate for the intended application. The key idea presented in this fragment is the argument pertaining to the need to enhance standards and apply uniform standards in court laboratories, which provides the foundation for their reliability, thus having a real influence on the administration of justice. The Author of the chapter under discussion has focused his attention on identifying potential reasons that may have an adverse effect on testingreliability and, generally, laboratory activity, defining the source of error in human activities or faulty devices and the quality of reagents used. In this respect, he makes certain recommendations, e.g. in order to avoid an error made by a person, tests should be performed in two-person teams by personnel having adequate skills and experience. He also postulates to effect mutual control at every stage of the testing process. Persons using devices should, on the other hand, strictly observe manuals and permanently monitor the operation of devices, as well as carefully control reagents, both upon purchase(conformity with the specification) and prior to introduction into testing (checking on archival samples).

In Section Six, being the last one, three chapters have been presented. The Authors of the first one are Magdalena Achrem and Kinga Łosińska. In their considerations of the application of miRNAs to body fluid identification and having assumed that the type and origin of body fluids secured at the crime scene, from which DNA is isolated, affects the probative value and usefulness of the samples, whereas the definition of the type and origin of body fluids secured at the crime scene may be essential in many cases to establish the relation between evidentiary material and the suspect, the Authors pointed that due to the inaccuracies in body fluid identification results and the fact that the newest methods of DNA typing allow to obtain results from small, degraded and even very old samples, it has been necessary to develop new methods of tissue and body fluid identification. One such method considers the use of biomarkers, and more precisely molecules of miRNA, that is short, of 18-24 nucleotides, ncRNAs (non-coding RNAs), that may regulate gene expression by means of posttranscriptional silencing. In the human genome there are fewer than 3,000 genes coding miRNAs. The biomarker in questionis not only characterized

by high effectiveness in identifying body fluids and high tissue specificity, but also, which is particularly important, great stability and resistance, which allows analysis of even a highly degraded biological material. The Authors have also noted that the advantage of miRNA, as a biomarker used for the identification of body fluids from biological traces is the fact that commercial isolation kits are already available enabling simultaneous extraction of DNA and RNA from one test material sample, which is useful in case of degraded specimens and with a small number of forensic traces;this reduces the risk of using up the material below the minimum value as necessary to obtain a DNA profile. A key drawback within the miRNA analysis – as results from the considerations presented – is the lack of methodological standardization (with respect to sample collection, miRNA extraction and quantification methods), brings about variable results in case of different research teams. The discussed chapter also dwells penetratingly on test results concerning the identification of body fluids: saliva, blood, semen or vaginal discharge, as well as determining the time of death on the basis of selected types of miRNA molecules. One conclusion derived from the research refers to the question ofdetermining the time of death on the basis of miRNA biomarkers. And so, differences in the expression of these miRNAs enabled the specification of four intervals of the time that has elapsed since an individual's death – under one month, between one and three months, between three and six months, over six months.

Chapter Two of the section being discussed has been prepared by Monika Ficek, Barbara Wąsowicz and Anna Rymaszewska in a study entitled *Genetic analysis methods used in forensic entomology*, which dwells on the role of forensic entomology in the investigation and the possibilities of molecular identification of necrophagous insects. The Authors have presented the evolution of the significance of necrophages in forensic testing. It is worth mentioning that the probative value of necrophagous fauna has not been ousted by molecular analyses, and, at the same time, modern molecular analysis techniques enable wider utilization of necrophages not only for the determination of the PMI, as they allow obtaining information about the place and circumstances of death, the corpse being moved, determination of the cause of death or even DNA profiling of a victim on whom necrophagous insect larvae have fed. The great number of variables having an influence on the time of appearance of first postmortem changes and the rate of decomposition make it impossible to precisely determine the PMI in any of the scientific ways as known currently. It is only possible to estimate the time of death. One of the more useful parameters are environmental factors which, among others, are related to insect activity. Entomological testing is based mostly on the species-specific identification of insects and knowledge regarding their life cycle. Various external factors may affect the dynamics of this cycle, though. The insects that are important from the point of view of forensic

entomology, i.e. flies (the Diptera) and beetles (the Coleoptera) undergo complete metamorphosis. The Authors have also exposed DNA analysis (molecular identificationofmitochondrial DNA, mtDNA) as an alternative to classical methods of forensic entomology. So far, researchers have managed to select many genetic markers that provide the opportunity to be applied in the identification of necrophagous fly species. One of the most important stages in genetic analyses is the selection of an appropriate isolation method, allowing the obtainment of the biggest possible quantities of high molecular weight DNA, even from a small amount of input material. The Authors' team original studies led to the conclusion that the most effective isolation method is the so-called column method, which allowed to obtain the biggest quantities of high molecular weight DNA in case of such materials as insect larvae and their adult stages. At the same time, the remaining methods: isolates from CTAB and their modifications, as well as the isolation by the organic method with DTT, did not differ one from the other as far as the quality of isolates obtained.

The third chapter of the last section has been prepared by Andrzej Ossowski and Maria Szargut. In this paper, entitled *mtDNA analyses, next-generation sequencing, phenotypic testing in identifying the donor of a biological material*, forensic genetic tools have been discussed in the form of the next/new generation sequencing (NGS), which enables simultaneous analysis of millions of DNA fragments that may carry information on, for instance, the appearance and biogeographical origin of the person who has left his/her trace at a crime scene, or whose remains have been recovered. They can also constitute fragments of mitochondrial DNA which, having been put together by means of bioinformatics tools, will be used to reconstruct the sequence of a complete mtDNA genome. The Authors state that the expansion of the NGS method provided for the development of a range of tools for translating genomic data into information about the appearance and biogeographical origin of a person wanted by law enforcement agencies or human remains recovered at a stage of decomposition that precludes identification. The newest tool of forensic genetics – FDP – however, allows us to estimate an increasing number of appearance features on the basis of an analysis of DNA left at the incident scene or, in case of identification testing, obtained from recovered human remains. The present state-of-the-art with respect to FDP allows prediction of such appearance features as: eye and hair colour (including its hue), skin colour, premature balding, scalp hair shape and its greying, some features of face morphology, presence of freckles, or hight of the body. Simultaneously, biogeographical origin estimation and phenotype prediction are not classified and classical tools of forensic genetics, neither do they allow the identification *sensu stricto* of a tested person. Potentially, however, they provide a helpful screening technique, limiting the circle of suspects, missing persons to whom given remains may have belonged, or point at a milieu or institution to whom it is worth

applying for help in the determination of the identity of the person whose profile has been obtained in the course of the tests. Similarly, mtDNA analysis, although it cannot lead to personal identification on its own, still it serves to verify hypotheses adopted by the investigators. In conclusion, the Authors stand for the necessity for legal and methodological standardization, that is creating new methodological and legal regulations to make use of NGS technologies.

It unequivocally arises from the overview of the standpoints, as presented, that the importance of forensic science and the so-called bridging sciences, together with the development of new testing technologies, is increasing and becoming a key element of effective criminal prosecution. The introduction of scientific evidence into the criminal procedure implies, however, that criminal prosecution bodies should be properly prepared. This is important at the stage of both detective and extractive actions, and the procedural appointment of an expert witness for the purpose of giving an opinion, or, eventually, while evaluating any means of evidence to have been obtained. Difficulties in dealing with such evidentiary material escalate in cross-border proceedings, when it is necessary not only to collect and secure the test and reference material, transfer the same to a foreign judicial authority, but to standardize testing methods and universalize result encoding to increase their admissibility, useability and procedural reliability. This project has assumed an exchange of knowledge and experiences between the law enforcement agencies of Poland and Germany, as well as a diagnosis of key problems related to forensic identification in cross-border proceedings. The range of issues presented allows the formulation of a conclusion that the existing legal framework enables effective cooperation of forensic laboratories and criminal prosecution bodies, still some incoherences are vulnerable that pertain, in a systemic manner, to the conditions of the legality of procedural acts in the Polish and German systems, such as, for instance, the issue of reporting, which is more widely applicable in the Polish system. The development of phenotyping techniques implies, at the same time, that certain legal framework should be created in connection with the establishment of the scope of obtainment and application of personal data for the purpose of criminal prosecution. An ongoing process of unification and standardization is, on the other hand required for the formula of forensic and testing activities, as well as technical ones (regarding the pragmatic aspect of obtaining, collecting and recording test and reference material). Thus, enhanced cooperation of criminal prosecution bodies must be supplemented by reinforced and correlated cooperation of forensic laboratories.

List of abbreviations

STR – short tandem repeats, aSTR – autosomal STR, Y-STR – Y-chromosomal STR

SNP – single nucleotide polymorphism, piSNP – phenotypically-informative SNP, aiSNP – ancestry--informative SNP

NGS – next/new generation sequencing

DNA – deoxyribonucleic acid, mtDNA – mitochondrial DNA

bp – base pairs

HV – hypervariable region

ISFG – International Society for Forensic Genetics

NN – nomen nescio (no name)

PGDVT – Polish Genetic Database of Victims of Totalitarianisms

HPS – high throughput sequencing

FGS – first generation sequencing (currently also known as: low throughput sequencing)

FDP – forensic DNA phenotyping

RMP – random match probability

CE – capillary electrophoresis