Ekonomichna bezpeka ta finansovi rozsliduvannia: kontsepty, prahmatyka, instrumentarii zabezpechennia: kolektyvna monohrafiia / za zah. red. d.e.n., dots. Vivchar O.I. Ternopil: Ekonomichna dumka, 2019. 395 s. (In Ukrainian).

7. Hryshchenko D. Zminy finansovoho monitorynhu. Biznes povynen povnistiu rozkryty informatsiiu pro strukturu vlasnosti / Informatsiinyi portal – LIGA360. 23.04.2020. URL: https://biz.ligazakon.net/ua/analitycs/194781_zmni-fnansovogo-montoringu-bznes-povinen-povnstyu-rozkriti-nformatsy u-pro-strukturu-vlasnost (In Ukrainian).

8. Matviichuk I.V., Pavlova N.V. Problemy realizatsii finansovoho monitorynhu v Ukraini. Aktualni pytannia kryminalistychnoho protsesu, kryminalistyky ta sudovoi ekspertyzy: materialy mizhvidomchoi naukovo-praktychnoi konferentsii (Kyiv, 24 lystopada 2017 roku). Kyiv: Natsionalna akademiia vnutrishnikh sprav, 2017. Ch.2. 405 s. S. 190-194. (In Ukrainian).

9. Serdyukova E.V. Modelirovanie finansovogo sostoyaniya organizatsii v ramkah finansovogo monitoringa. Ekonomicheskie nauki. 2019. # 7(56). S. 267-269. (In Russ).

10. Chuykova N. M. Finansovyiy monitoring kak instrument protivodeystviya ugrozam finansovoy bezopasnosti gosudarstva i biznesa. Ekonomika i predprinimatelstvo. 2015. #. 12-3. S. 843-849. (In Russ).

11. Ovsyannikov S.V. Finansovyiy monitoring kak instrument kriziso-ustoychivogo razvitiya predpriyatiya. Territoriya nauki. 2015. #4. (In Russ).

12. Molchanov D. Udoskonalennia administratyvno-pravovoho rehuliuvannia finansovoho kontroliu ta monitorynhu yak zasobiv protydii tinizatsii ekonomiky Ukrainy z urakhuvanniam mizhnarodnoho dosvidu. Pidpryiemnytstvo, hospodarstvo i pravo. 2017. №. 10. S. 117-122. (In Ukrainian).

13. Zakonodavstvo shchodo finansovoho monitorynhu. / Ofitsiinyi sait ministerstva yustytsii Ukrainy. URL: https://minjust.gov.ua/finmonit_zakon (In Ukrainian).

14. Zakon Ukrainy «Pro zapobihannia ta protydiiu lehalizatsii (vidmyvanniu) dokhodiv, oderzhanykh zlochynnym shliakhom, finansuvanniu teroryzmu ta finansuvanniu rozpovsiudzhennia zbroi masovoho znyshchennia» vid 14 lypnia 2020 roku N 768-IX. URL: https://ips.ligazakon.net/document/view/t190361?an=1184 (In Ukrainian).

15. 28 kvitnia nabyraie chynnosti novyi zakon pro finansovyi monitorynh / Derzhavna sluzhba finansovoho monitorynhu Ukrainy. URL: https://www.kmu.gov.ua/news/28-kvitnya-nabiraye-chinnosti-novij-zakon-pro-finansovij-monitoring (In Ukrainian).

16. Dynamika informuvannia SPFM pro finansovi operatsii protiahom 2015-2019 rokiv/ Derzhavna sluzhba finansovoho monitorynhu Ukrainy. URL: https://fiu.gov.ua/pages/dijalnist/funkcional/statistika-ta-infografika/Infografika/Infografika-za-2019-rik/dinamika-informuvannya-spfm-pro-finansovi-operacziji-protyagom-2015-2019-rokiv.html (In Ukrainian).

Yakovlev Dmitry Yuryevitch
PhD in Law, Associate Professor Irkutsk Law Institute (Branch)
of the University of prosecution of the Russian Federation

FORENSIC RESEARCH OF PROTEIN STRUCTURES: FOREIGN EXPERIENCE

Abstract. The article discusses the methods of forensic research of protein structures used in foreign countries. The effectiveness of various methods of structural and elemental analysis of protein compounds and complex protein complexes in the study of various physical evidence is discussed. High efficiency of immunological and immunochemical methods of analysis is noted. The issues of automation of forensic research are considered.

Keywords: crime investigation, forensic examination abroad, protein structures, physical evidence, immunological research methods, blood, saliva, semen.

One of the scientifically based methods for determining the presence of seminal fluid on a carrier object used abroad is the determination of the antigen of sperm vesicles by enzyme immunoassay or Immunoradiometric analysis[8]. At the same time, the immunochromatographic method for determining prostate specific antigen[9] and semenogelin is widely used[10]. To solve such problems, the method of reverse liquid chromatography with simultaneous treatment of the studied material with phenolphthalein, proposed by a group of Japanese researchers, has proven itself well[11]. It should be noted that microscopic methods for examining traces that cause suspicion of spermatozoa are used only in extreme cases, when the use of

[8] Chen J. T., Hortin G. L. Interferences with semen detection by an immunoassay for a seminal vesicle-specific antigen // J. Forensic Sci. – 2000. – Jan. - 45(l). P. 234-235.

[9] Laux D. L., Barnhart J. P. Validation of the Seratec SeraQuant for the Quantitation of Prostate-Specific Antigen Levels on Immunochromatographic Membranes // J. Forensic Sci. – 2011. – Nov. - 56(6). – 1574 - 1579.

[10] Laffan A., Sawyer I., Quinones I., Daniel B. Evaluation of semen presumptive tests for use at crime scenes // Med. Sci. Law. – 2011. - Jan. - 51(l). P. 1 - 7.

[11] Yoshida M., Akane A., Mitani T., Kobayashi T., Okii Y. Examination of seminal stain by HPLC assay of phenolphthalein // Leg. Med. - 2009. -Vol. 11. - N 1. - P. 357 - 359.

immunological research methods was unsuccessful, but there is a positive reaction to acid phosphotase.

As for determining the group membership of seminal fluid according to the ABO system, the method of enzyme immunoassay is most widely used in foreign practice, as well as in the study of blood protein structures[12]. In addition to the above, an immunocytochemical method is used to solve the described problems[13]. There is an application of the immunofluorescence reaction and a mixed agglutination reaction to determine the group membership of seminal fluid according to the ABO system[14]. However, to determine the group membership of spermatozoa by the SRM9 antigen system, immunoelectrophoresis[15] is used, and the NS-11 antigen is an immunofluorescence reaction[16]. The enzyme immunoassay method is also used to type seminal fluid using the HLA system[17]. In addition, acrosomal antigen is determined by enzyme immunoassay and immunofluorescence reaction[18], HS-63 antigen is determined by immunofluorescence reaction[19], and immunoglobulins G and M are determined[20].

In Foreign expert practice, the immunocytochemical method for determining the group membership of bone residues, epithelial cells and hair is successfully used[21].

Some success has been achieved by foreign experts in the field of introducing detection of organ-specific antigens in traces of biological origin on various carrier objects. Unfortunately, there is no such practice in our country.

In this case, we are talking primarily about the brain marker – the S-100 protein[22] and the liver marker LSA[23]. Similarly, markers of the heart and small intestine were studied[24]. This allows us to solve a number of diagnostic tasks related to the detection of various organ-tissue layers on a traumatic instrument. If these antigens are detected by enzyme immunoassay in traces of biological origin, then we can talk about damage to a particular organ.

To detect saliva in traces of biological origin, foreign experts use the following methods: Fadebase amylase test[25], visual urine amylase test[26], strips[27], enzyme immunoassay[28] and kinetic method[29].

Blood traces belonging to a pregnant woman are determined by the concentration of various hormones of biological origin in the trace: estradiol, progesterone, human chorionic gonadotropin, placental lactogen, α – fetoprotein by enzyme immunoassay and immunoagglutination reaction[30].

---

[12] Sato I., Nakamura A., Ujiie K., Yukawa N., Nakajima Y. A sandwich enzyme-linked immunosorbent assay for ABO blood typing of semen by using anti-p 84 monoclonal antibody as a marker of blood group substance in semen // J. Forensic Sci. – 2000. - Jul. - 45(4). – P. 795 - 800.

[13] Scheithauer R., Hofmann R. Immunocytochemical typing of ABO blood groups in vaginal swabs partly contaminated with semen // Int. J. Legal Med. – 1991. - Mar. - 104(2). – P. 87 - 91.

[14] Kerek G. Distribution of the blood group antigens A and B on human spermatozoa// Int J. Fertil. – 1974. - 19(4). – P. 181 - 191.

[15] [15] Scacciati J. M., Mancini R. E. Soluble and insoluble antigens of human spermatozoa//Fertil Steril. – 1975. – Jan. - 26(1). P. 6 - 12.

[16] Hinrichsen-Kohane A. C., Hinrichsen M. J, Schill W. B. Analysis of antigen expression on human spermatozoa by means of monoclonal antibodies // Fértil Steril. – 1985. - Feb. - 3(2). P. 279 - 285.

[17]Hinrichsen-Kohane A. C., Hinrichsen M. J, Schill W. B. Analysis of antigen expression on human spermatozoa by means of monoclonal antibodies // Fértil Steril. – 1985. - Feb. - 3(2). P. 279 - 285.

[18] Kallajoki M., Suominen J. An acrosomal antigen of human spermatozoa and spermatogenic cells characterized with a monoclonal antibody // Int. J. Androl. – 1984. – Aug. - 7(4). - P. 283 -296.

[19] Chao H. T., Ng H. T., Leng C. H., Lee C. Y., Wei Y. H. Electron microscopic immunolocalization of a conserved sperm acrosomal antigen recognized by HS-63 monoclonal antibody / /Andrologia. – 1993. - Jul-Aug. - 25(4). – P. 203 - 210.

[20] Czuppon A. B., Mettler L., Schauer R., Pawassarat V. Purification of a human spermatozoal antigen // Hoppe Seylers Z. Physiol. Chem. – 1981. - Jul. - 362(7). – P. 963-968.

[21] Klir P. The ABO group system in tissues in advanced post-mortem changes // Soud Lek. – 1994. – Dec. - 39(4). – P. 32 - 325; Brinkmann B., Kernbach G., Rand S. Cytochemical detection of ABH antigens in human body fluids // Z. Rechtsmed. – 1986. - 96(2). – P. 111-117.

[22] Seo Y., Kakizaki E., Takahama K. A sandwich enzyme immunoassay for brain S-100 protein and its forensic application // Forensic Sci. Int. – 1997. – Jun. - 87(2). – P. 145 - 154.

[23] Seo Y., Takahama K. A highly sensitive sandwich enzyme immunoassay for human liver-specific antigen (LSA) and its forensic application // Nihon Hoigaku Zasshi. – 1994. – Jun. - 48(3). – P. 150 - 155.

[24] Takahama K. Medico-legal studies on detection of organ-specific antigens // Nihon Hoigaku Zasshi. – 1993. – Dec. - 47(6). - P. 445 - 455.

[25] Hafkensheid J.C. Results by the Phadebas amylase test for human sera in the presence and absence of albumin // Clin. Cheme. - 1978. - Vol. 24. - N 11. - P. 2061-2062.

[26] Uldall A. Visual tests for urinary amylase investigated in routine laboratory // Scand. J. Clin. Lab. Invest. - 1985. - Vol. 45. - N 2. - P. 189 - 192.

[27] Keating S. M., Higgs D. F. The detection of amylase on swabs from sexual assault cases // Forensic Sci. Int. - 1994. - Vol. 34. - N 2. - P. 89 - 93.

[28] Quarino L., Dang Q., Hartman J., Movnihan N. An ELISA method for the identification of salivary amylase // J. Forensic Science. - 2005. - Vol. 50. - N 4. - P. 873 - 876.

[29] Barni F., Berti A., Rapone C., Lago G. Alpha-amilaze kinetic test in bodily single and mixed stains // J. Forensic Science. - 2006. - Vol. 51. - N 6. - P. 1389 - 1396.

[30] Vallego G. Human chorionic gonadotropin detection by means of enzyme immunoassay: a uswful method in forensic pregnancy diagnosis in bloodstains // J. Forensic Sci. - 1990. - Vol. 35. - N 2. - P. 293 - 300.; Vergote G., Heyndrickx B., Paredes M., Daels J. Forensic determination of pregnancy hormones in human bloodstains // J. Forensic Sci. Soc. - 1991. - Vol. 31. – N 4. - P. 409 - 419.; Voss P., Linneke P., Haller G., Jeske W. Reference values for progesterone, beta-HCG, estriol and human placental lactogen in 10th-16th weeks of pregnancy // Zentral bl. Gynakol. - 1989. - Vol. 111. - N 13. - P. 897 – 903.

Thus, it should be noted that in foreign countries, a wide range of specific highly sensitive techniques aimed at solving substantive and metric expert problems is used in the production of expert studies of protein structures. Computer algorithms for calculating the results are actively used. This leads, first of all, to increasing the objectivity of the study, minimizing the influence of subjective factors on the course and results of the study.

The introduction of the latest technologies allowed foreign specialists to make a qualitative breakthrough in the expert study of protein structures. Moreover, such a breakthrough is based not on the inclusion of new research objects in the sphere of expert activity, but on a deeper, often complex approach to the study of the latter.

In our country, due to a number of objective reasons, including economic difficulties, the outflow of qualified personnel, the low professional level of the investigative corps, the shortcomings of the system of training and retraining of professional personnel, the described methods and techniques for studying protein structures have not been properly developed. Only at the beginning of the XXI century, on the basis of some state forensic medical institutions, some highly sensitive methods of analysis were introduced into the practice of expert research.

The solution to this problem is seen in improving existing modern methods for studying protein structures, introducing the latest research methods, including foreign ones, into expert practice, and developing a new comprehensive methodological approach to solving identification and diagnostic problems of protein structure research.

1. Barni F., Berti A., Rapone C., Lago G. Alpha-amilaze kinetic test in bodily single and mixed stains // J. Forensic Science. - 2006. - Vol. 51. - N 6. - P. 1389 - 1396.

2. Chao H. T., Ng H. T., Leng C. H., Lee C. Y., Wei Y. H. Electron microscopic immunolocalization of a conserved sperm acrosomal antigen recognized by HS-63 monoclonal antibody / /Andrologia. – 1993. - Jul-Aug. - 25(4). – P. 203 - 210.

3. Chen J. T., Hortin G. L. Interferences with semen detection by an immunoassay for a seminal vesicle-specific antigen // J. Forensic Sci. – 2000. – Jan. - 45(l). P. 234-235.

4. Czuppon A. B., Mettler L., Schauer R., Pawassarat V. Purification of a human spermatozoal antigen // Hoppe Seylers Z. Physiol. Chem. – 1981. - Jul. - 362(7). – P. 963-968.

5. Hafkensheid J.C. Results by the Phadebas amylase test for human sera in the presence and absence of albumin // Clin. Cheme. - 1978. - Vol. 24. - N 11. - P. 2061-2062.

6. Hinrichsen-Kohane A. C., Hinrichsen M. J, Schill W. B. Analysis of antigen expression on human spermatozoa by means of monoclonal antibodies // Fértil Steril. – 1985. - Feb. - 3(2). P. 279 - 285.

7. Hinrichsen-Kohane A. C., Hinrichsen M. J, Schill W. B. Analysis of antigen expression on human spermatozoa by means of monoclonal antibodies // Fértil Steril. – 1985. - Feb. - 3(2). P. 279 - 285.

8. Kallajoki M., Suominen J. An acrosomal antigen of human spermatozoa and spermatogenic cells characterized with a monoclonal antibody // Int. J. Androl. – 1984. – Aug. - 7(4). - P. 283 -296.

9. Keating S. M., Higgs D. F. The detection of amylase on swabs from sexual assault cases // Forensic Sci. Int. - 1994. - Vol. 34. - N 2. - P. 89 - 93.

10. Kerek G. Distribution of the blood group antigens A and B on human spermatozoa// Int J. Fertil. – 1974. - 19(4). – P. 181 - 191.

11. Klir P. The ABO group system in tissues in advanced post-mortem changes // Soud Lek. – 1994. – Dec. - 39(4). – P. 32 - 325; Brinkmann B., Kernbach G., Rand S. Cytochemical detection of ABH antigens in human body fluids // Z. Rechtsmed. – 1986. - 96(2). – P. 111-117.

12. Laffan A., Sawyer I., Quinones I., Daniel B. Evaluation of semen presumptive tests for use at crime scenes // Med. Sci. Law. – 2011. - Jan. - 51(l). P. 1 - 7.

13. Laux D. L., Barnhart J. P. Validation of the Seratec SeraQuant for the Quantitation of Prostate-Specific Antigen Levels on Immunochromatographic Membranes // J. Forensic Sci. – 2011. – Nov. - 56(6). – 1574 - 1579.

14. Quarino L., Dang Q., Hartman J., Movnihan N. An ELISA method for the identification of salivary amylase // J. Forensic Science. - 2005. - Vol. 50. - N 4. - P. 873 - 876.

15. Sato I., Nakamura A., Ujiie K., Yukawa N., Nakajima Y. A sandwich enzyme-linked immunosorbent assay for ABO blood typing of semen by using anti-p 84 monoclonal antibody as a marker of blood group substance in semen // J. Forensic Sci. – 2000. - Jul. - 45(4). – P. 795 - 800.

16. Scacciati J. M., Mancini R. E. Soluble and insoluble antigens of human spermatozoa//Fertil Steril. – 1975. – Jan. - 26(1). P. 6 - 12.

17. Scheithauer R., Hofmann R. Immunocytochemical typing of ABO blood groups in vaginal swabs partly contaminated with semen // Int. J. Legal Med. – 1991. - Mar. - 104(2). – P. 87 - 91.

18. Seo Y., Kakizaki E., Takahama K. A sandwich enzyme immunoassay for brain S-100 protein and its forensic application // Forensic Sci. Int. – 1997. – Jun. - 87(2). – P. 145 - 154.

19. Seo Y., Takahama K. A highly sensitive sandwich enzyme immunoassay for human liver-specific antigen (LSA) and its forensic application // Nihon Hoigaku Zasshi. – 1994. – Jun. - 48(3). – P. 150 - 155.

20. Takahama K. Medico-legal studies on detection of organ-specific antigens // Nihon Hoigaku Zasshi. – 1993. – Dec. - 47(6). - P. 445 - 455.

21. Uldall A. Visual tests for urinary amylase investigated in routine laboratory // Scand. J. Clin. Lab. Invest. - 1985. - Vol. 45. - N 2. - P. 189 - 192.

22. Vallego G. Human chorionic gonadotropin detection by means of enzyme immunoassay: a uswful method in forensic pregnancy diagnosis in bloodstains // J. Forensic Sci. - 1990. - Vol. 35. - N 2. - P. 293 -

300.; Vergote G., Heyndrickx B., Paredes M., Daels J. Forensic determination of pregnancy hormones in human bloodstains // J. Forensic Sci. Soc. - 1991. - Vol. 31. – N 4. - P. 409 - 419.; Voss P., Linneke P., Haller G., Jeske W. Reference values for progesterone, beta-HCG, estriol and human placental lactogen in 10th-16th weeks of pregnancy // Zentral bl. Gynakol. - 1989. - Vol. 111. - N 13. - P. 897 – 903.

23. Yoshida M., Akane A., Mitani T., Kobayashi T., Okii Y. Examination of seminal stain by HPLC assay of phenolphthalein // Leg. Med. - 2009. -Vol. 11. - N 1. - P. 357 - 359.