Hungarian Institute for FORENSIC SCIENCES
Természettudományok a bűnüldözés szolgálatában

HUNGARIAN INSTITUTE FOR FORENSIC SCIENCES

ACTIVITIES, ORGANIZATION, TASKS AND INSTRUMENTS

2015

The Institute

The wide range introduction and use of modern techniques in crime investigations has began by the foundation of **Institute for Forensic Techniques**, the predecessor of the present Institute, **in 1961**. The duty of Institute became gradually wider and wider by the development of forensic sciences. Following the traditional techniques – firearm-, bloodstain-, finger- and footprint investigation, and legal medicine tasks – physical and chemical studies were introduced. It was the beginning of a new era when the gas-chromatographic method for determination of blood alcohol level of large scale was initiated in 1971. The separation of serological, biological and histological methods was also a milestone in the history of the Institute.

In 1990 the Institute became independent under its new name; **Institute for Forensic Sciences** and it functioned as background institution of the Ministry of Interior (MI) till 1994, when it was subordinated to the National Police (NP), later in 2003 to MI again, than in 2008 to Ministry of Justice and Law-enforcement, finally to NP in 2011.

In 2011, by a large scale rearrangement, the departments of traditional techniques and that of natural sciences were unified in the division of experts and the division of forensic techniques were founded introducing the tasks of special crime scene investigation, the legal medicine, the polygraph studies and of the national inspectorate into the **Hungarian Institute for Forensic Sciences (HIFS).**

Heads & Contacts

The director of the Hungarian Institute for Forensic Sciences is **Dr. Gábor Nagy honorary associate professor**. The deputy directors are Márton Lontai (head of Expert Division) and Dr. Gergely Gárdonyi lieutenant colonel of police (head of Criminal Division).

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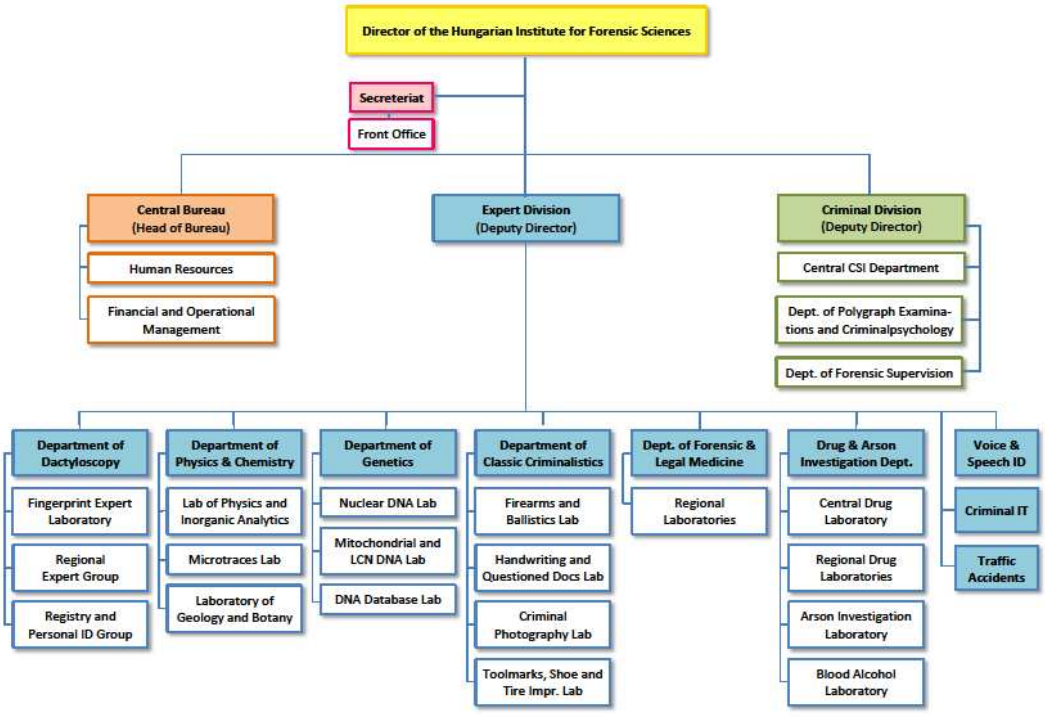
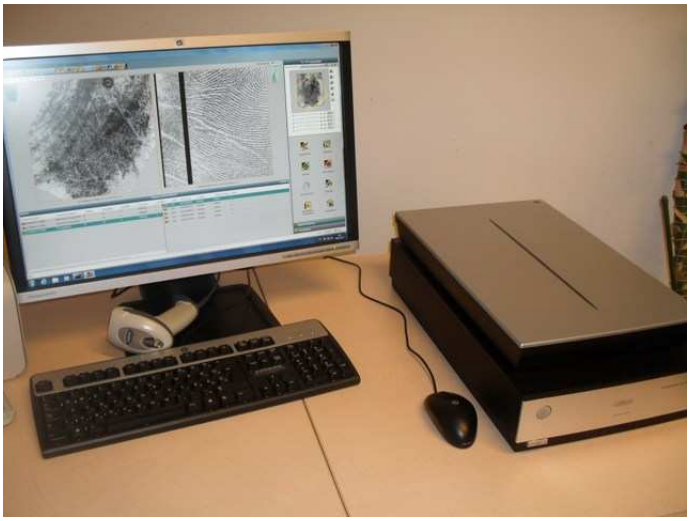
Organization Chart



Department of Dactyloscopy

The experts of the Department handles (encodes, identifies or excludes) the finger- and palm prints found on scene of unsolved crimes by the help of **AFIS** (Automatic Fingerprint Identification System), if they are suitable for detection. They perform person identification based on fingerprints in case of unknown corps or at person using false name. They handle the national forensic finger and palm print database and the fingerprint database of political asylum seekers and the national database of immigrants, separated from each other. By the **EURODAC** system and in the frame of **Prüm Treaty** the department takes part in international information and data exchange.

LIVESCAN: for the fingerprints which come from law enforcement agencies. This station continuously send the international standardized NST file including the fingerprints with palmprints to the AFIS if the new person comes for fixing.



Evaluation workstation with batch or flatbet scanner: it can be used for the latent scanning.

After scanning or recieving the incoming file from the livescan station, the fingerprint cards will be searched in the law enforcement database. Then automatically go to search in the tenprint database as well. The expert can use the several type of search including the tenprint-tenprint (TP-TP); tenprint-latent (TP-LT); latent-tenprint (LT-TP); latent-latent (LT-LT).

Department of Physics and Chemistry

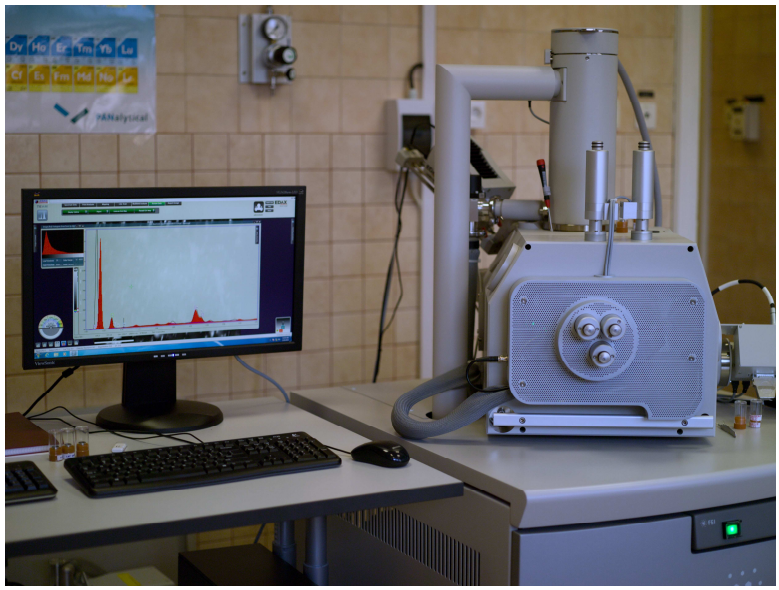
The **chemical, physical and geological research experts** of the Department perform experiments on any kind of exhibits, inorganic and non-biological organic remains which can prove the existence of crime. Beyond this task the physical research experts take part in solution of theoretical problems like reconstruction of events (way of human body's falling). The geological experts analyze and compare earth (soil, rocks, minerals, fossils) and building materials (bricks, mortar, concrete), together with the botanical traces (seeds, woody parts, pollens) found on various objects (suspect's shoes, vehicle etc.) to possible source areas (crime scene, alibi location etc.). The goal of these investigations is to establish whether the questioned material was or was not derived from a particular location. The chemical experts perform identifications by the help of instrumental analytical experiments, collections of different materials, and that of spectrum databanks. To perform the instrumental experiments optical microscopes, scanning electron-microscope, X-ray spectroscope, and infrared microscope coupled FTIR spectrophotometer and

microscope Raman spectrometer are available. The experts of the Department are active members of the ENFSI (European Network of Forensic Science Institutes) Fibres Working Group.

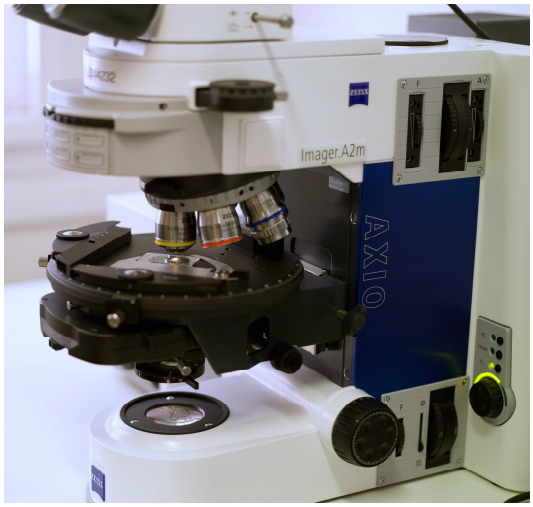
M4 TORNADO Micro X-Ray Fluorescence Spectroscope (Micro-XRF)

Micro-XRF is the method of choice for highly sensitive and non-destructive elemental analysis of diverse samples, including any kind of inorganic, organic and even of liquid samples. This instrument is suitable for analysis of very small samples, for example glass particles under 0,1 mm. The map of elemental distribution in samples can be obtained by automatic software option. Because of the large sample chamber of the instrument it is suitable for measuring whole items as knives, hammers, rocks etc.

Quanta 650 Scanning Electron Microscope (SEM)



Our new SEM is versatile, high-performance instrument with three modes (high vacuum, low vacuum and environmental mode) which enable the investigation of widest range of samples occuring in forensic practice from metals to biological samples. SEM system produces high resolution images of surface topography of sample and provide an information about the elemental composition of the specimens as well (EDS). The instrument is equipped with special analytical system and software for automatical analysis of gunshot residues (GSR).



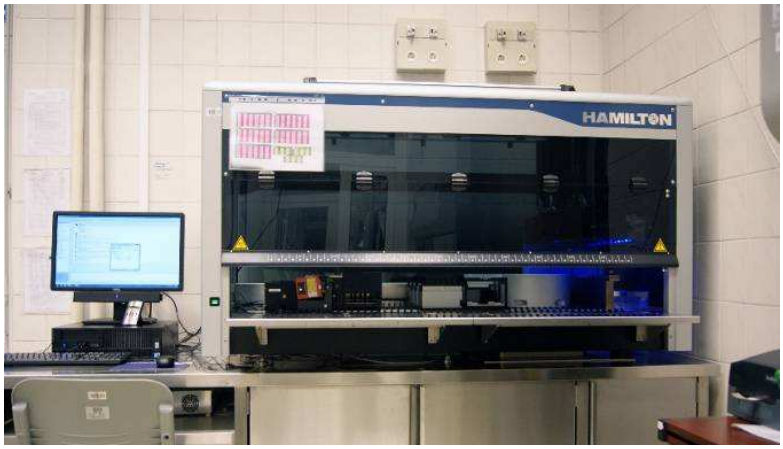
High performance optical microscopy system: AXIO Imager A2m optical microscope + SteREO Discovery V8 stereomicroscope

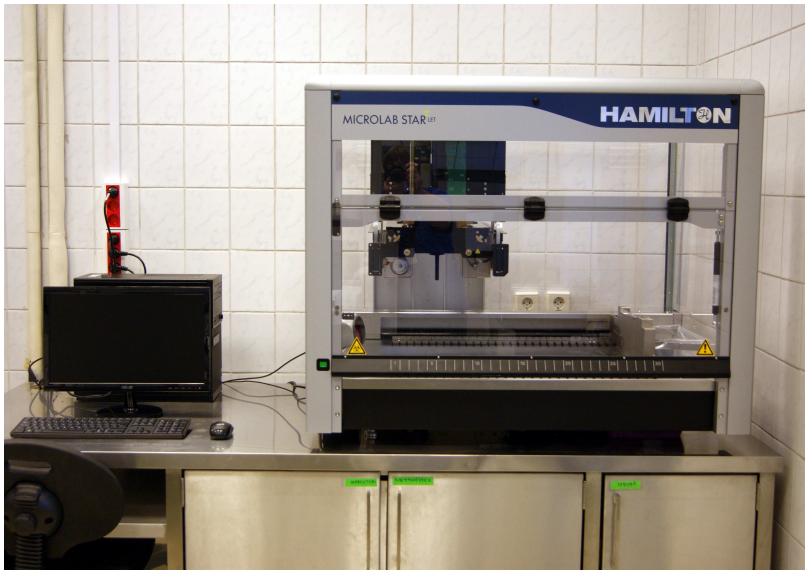
These two apposed optical microscopies serve as a complex system for morphological examination of any kind of microtraces. The AXIO Imager microscope is equipped with fluorescent and polarized light illumination possibilities and digital camera. The imaging is software controlled which facilitate the high quality image and using different image analyser function. The ergonomy of stereomicroscope enables the investigation of large specimens.

Department of Genetics

The Department of Medical Experts was transformed into Department of Biology in 1991, which has been separated into Department of Medical Experts and of Hemogenetics, later renamed as Department of Genetics. This department carries out the comparative study of core and mithocondrial human DNA from biological remains on different exhibits for person identification following international guidelines. Based on the expert activity the Department has the duty to maintain and manage the the national forensic **DNA database**. The **CODIS** based database has complete comparability to international databases, which enables the Department to take part in international data exchange in the frame of **Prüm Treaty**.
Beyond the expert work the employees of the Department take part in different scientific projects, aiming the development of technology of forensic genetics.

Hamilton AutoLys STAR 4+4 robotic workstation: This freely programmable high-throughput pre-PCR instrument allows the simultaneous processing of up to 72 swabs or other simple samples from autolysis through quantification to STR-PCR set-up within 12 hours. It can be adjusted to the proper management of different preparative kits (e.g., PrepFiler Automated Forensic DNA Extraction Kit - Applied Biosystems, DNA IQ System Kit - Promega, etc.) as well as the most widely used STR-PCR kits (e.g., AmpFlSTR NGM SElect Amplification Kit - Applied Biosystems, PowerPlex ESI 17 Pro Systems - Promega, etc.). Sample tracebility is proven by the use of 1D and 2D barcodes.

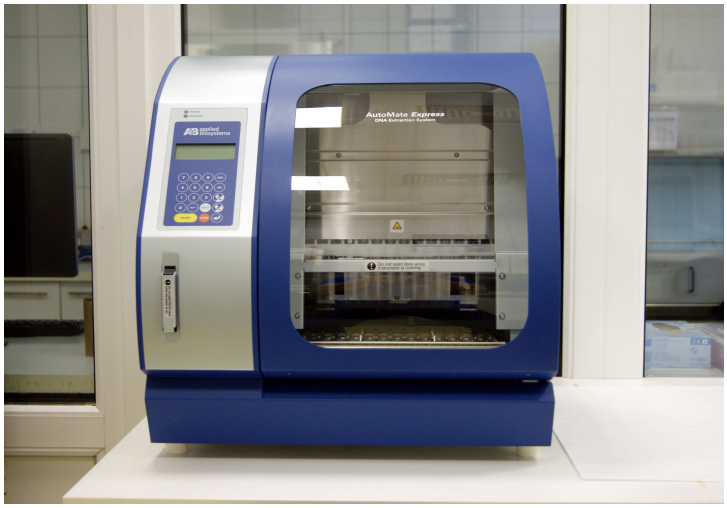




Hamilton StarLet 4 ML robotic workstation: This freely programmable high-throughput post-PCR instrument allows the simultaneous processing of up to 25 plates within couple of hours. It can be adjusted to the proper management of almost any kind of post-PCR sample set-up processes. Sample tracebility is proven by the use of 1D and 2D barcodes.

Applied Biosystems AutoMate Express robotic workstation: This stand alone medium-throughput pre-PCR instrument allows the simultaneous processing of up to 13 swabs or other simple samples from autolysis to DNA extract within 1-2 hours. It can be adjusted to the proper

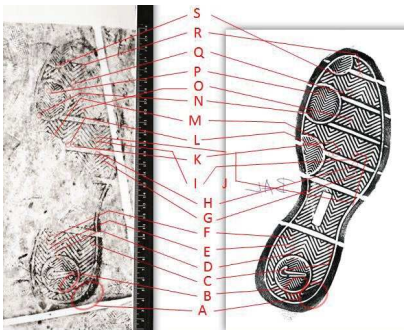
management of sometimes problematic sample types (e.g., hairs, bones, etc.). Sample tracebility is proven by the use of 1D barcodes.

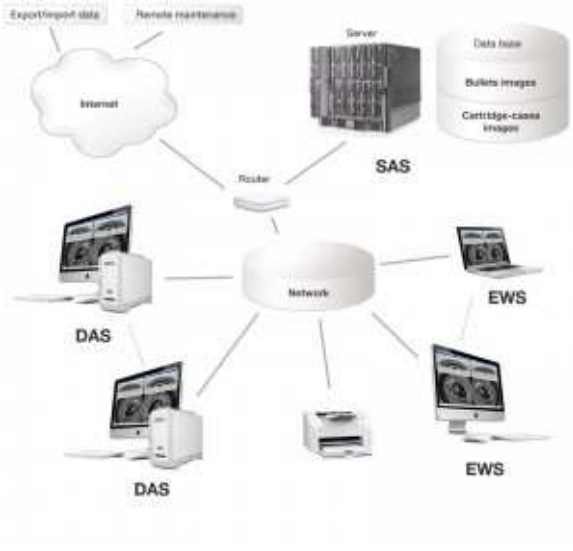


Applied Biosystems 3500 xL Genetic Analyser: This high-throughput post-PCR instrument allows the simultaneous processing of up to 24 samples within 1 hour. Due to its 6-dye compatibility there is no problem with the most informative STR-PCR kits (e.g., GlobalFiler PCR Amplification Kit - Applied Biosystems, PowerPlex Fusion Systems - Promega, etc.) currently available on the market. Sample tracebility is proven by the use of 1D barcodes.

Department of Classic Criminalistics

The members of Department are the experts acting on the field of classical criminalistics, ie. **toolmarks**, **shoe and tire impressions**, **firearms**, **ballistics**, **handwriting** and **questioned documents**. By their expert study of varied exhibits carrying any kind of prints they help in solution of crimes committed against person or material goods, by the use of document or handwriting or that of traffic crimes. To perform their study special microscopes, bullet speedometer and special equipment for document investigation are available.

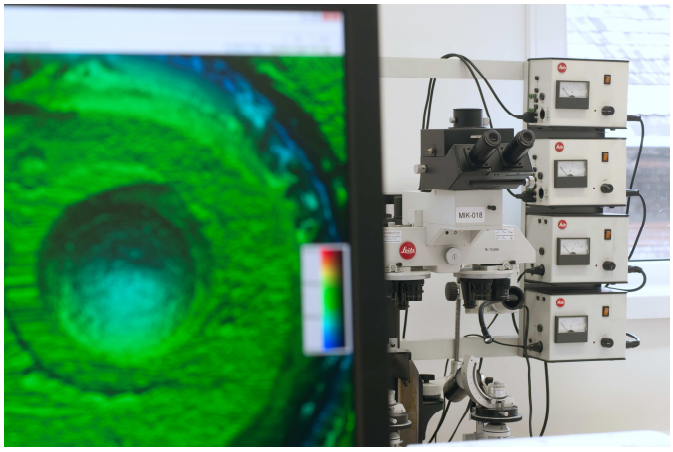




In December 2014 the Department has been developed with **Ballistic Identification System** (BIS) EVOFINDER 4x4. The system in our lab consist of a Specimen Analysis System (SAS), a Data Acquisition Stations (DAS) and an Expert WorkStations (EWS).

The SAS is aimed to operate of BIS EVOFINDER®, to carry out an automatic identification of the object under examination against the objects in the database and store high-quality digital images with corresponding information. The DAS is aimed for digital recording of the objects surfaces – "virtual" objects creation — and saving them in the database. The EWS is aimed for carrying out ballistic expertise (identification) as well as sending the request to the SAS for automatic correlation of the "virtual" objects stored in the database. That provides the experts a list of similar objects for taking a final decision as to the expertise results.

In our open case files (OCF), we have 2500 speciments and these samples were digitalised from the end of December to the end of February 2015.



Firearms and Ballistics Lab

Handwriting and Questioned Docs Lab

Department of Forensic and Legal Medicine

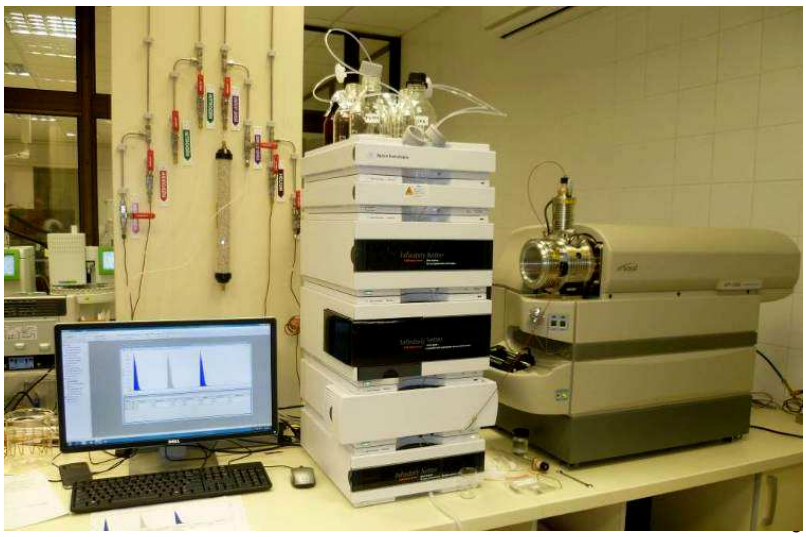
Among the staff of Hungarian Police legal physicians have always served from the very beginning. Beyond the classical legal medical tasks – like **inspection of body on scene** – they have sphere of authority, later they provided forensic medical tasks as well. This hegemony is followed by the Department integrated into HIFS. Now the forensic physicians are experts having qualified in legal

medicine, who help the work of authorities by their knowledge mainly by body inspections on crime scene. With a great expansion started in 2015 our forensic medidice duty is growing into a countrywide network with the implementation of the national network of forensic physician experts.
The Department - to demonstrate pathological disorders, to determine cause of death - also performs **histological studies** on tissues originated from official or legal medical post-mortems. It performs morphological study of **human hair**, and determination the class of **diatoma** from lung samples of drawn people. By their expertise the members of Department help in solution of crimes committed against person or material goods, of sexual assaults, traffic accidents, and in proof of drug or people smuggling. The medical experts of Department compiles expertise on alcohol concentration in blood at the time of criminal event based on blood or breath alcohol data or on statement on beverage consumption.

Drug and Arson Investigation Department

The work of the experts in the **Drug and Arson Investigation Department** is based on modern analytical instruments and techniques: chromatography and spectroscopy. The seized drugs are analyzed in Budapest in the **Central** and the **Regional Drug Laboratories** operate in Debrecen, Győr, Pécs, Szeged and Veszprém.
These laboratories form a national network. Their main tasks consist of the identification of the drugs and of measuring the quantity of the active substance. The international recognition of the work of the laboratory network is proven by the fact that since 2010 the Central Drug Laboratory has been entrusted by the ENFSI drug working group to organize and evaluate its proficiency tests. From the 68 laboratories taking part in the proficiency test of UN in 2011 Hungarian laboratory received the best score based on the cumulated data. **Arson Investigation Laboratory** performs the analysis of samples connected to fires, fuel and lubricant thefts, and traffic accidents. The determination of alcohol level of the blood and urine samples also belongs to the tasks of Department after the reconstruction of the **Blood-alcohol Laboratory** in 2012.

LC/MS/MS
From all over the country more than 10.000 blood and urine samples were received in the Hungarian Institute for Forensic Sciences. Determination of the central nervous system (CNS) affecting drugs in these biological human samples would serve comprehensive information about habits of drug user and drug abuse.



The current purchased equipment gives the possibility for screening of influences of drugs and new psychoactive substances (NPSs). It is suitable for determining drug molecules and NPSs and their metabolites in blood and urine samples. Numbers of criminal offenses related to driving under the influence of drugs or NPSs could be decreased by continuous screening of the corresponding biological human samples.

Robot

The number of cases increased year by year in the Central Drug Investigation Laboratory. One of the possibilities for capacity development is maximize of automation instead of human workers, consequently the human intervention and occurring inaccuracies were narrowed down. The purchased robot is able to accomplish whole preparation procedures from weighting via solution preparing, filtering to the final required analytical sample form, such as a solution in closed vial ("ready to inject"). With the installation of the robot, significant increasing capacity and reliability will have been anticipated in the Central Drug Investigation Laboratory.

Regional Drug Laboratories

Central Crime Scene Investigation Department

The activity of the Institute was always characterized by the harmony of crime scene and expert activities. The exhibits and remains tracked down and collected by the technicians on the crime scene for answering the basic questions became valuable by the analytical, comparative study of experts. The task of Department first of all is to find the evidences on crime scene using the most suitable scientific and technical tools and methods available. In the second place the task is to open up the characteristics and changes of objects tracked down, on the scene and in the laboratory to prepare them for the further expert analysis and comparative studies.

High luminosity lamp set

Sirchie megaMAXX™ 3-Watt Alternate Light System: forensic light sources for detecting different types of traces, especially biological microtraces

Drone – Multi-rotor helicopter: for exploration and photodocumentation on large open field crime scenes, even from 150m altitude. Remote-controlled, equipped with a digital or an infrared camera.

Noggin 250 SmartCart ground penetrating radar system: the soil radar emits electromagnetic waves which are able to detect anomalies in the soil structure during searching for buried victims. Waves may penetrate down to water level and the radar is capable to visualize 30m depth.

3D Leica laser scanner: for 3D digitalization of an area of 200m radius, with laser scanning method. The device creates a point cloud and several photos, after the scanning process these will be merged, resulting in a photo-realistic, perfectly scaled 3D scene reconstruction, which can be used later for measurement and several forensic analyses (e.g. determining projectile trajectories, analyzing bloodstain patterns)

KRIMESITE Imager Master RUVIS Kit: for detection, examination and documentation of latent fingerprints, usueful on crime scenes and in laboratory as well. The device works within UV range thus the fingerprints become visible without any treatment, even in daylight.

FLIR E8 thermal camera: for investigation of crime scenes, detection of living persons and human remains.

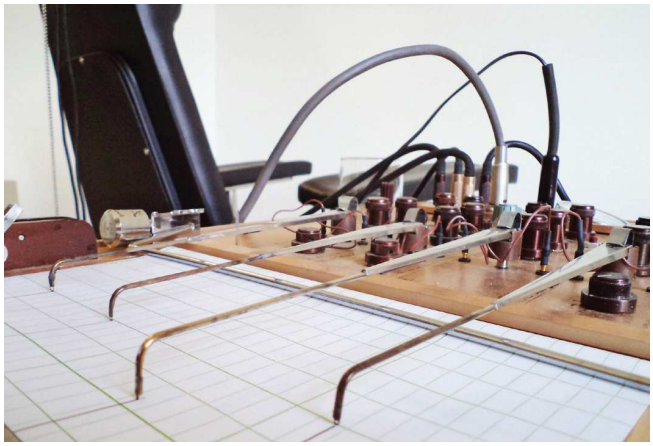
Nikon D610 semi-professional DSLR Camera with Samyang/Rokinon 24mm f/3.5 Tilt-Shift Lens and Macro flash: a high quality camera with professional perspective control and macro lighting.

Department of Forensic Supervision

The Department performs the **control and guidance of crime scene committees** carrying out forensic or executive inspections with nationwide sphere of authority. Its guidance activity is executed on two levels; mainly on crime scene and secondly by subsequent analysis and evaluation of crime scene documentations. The main task of Department is to rise further the standard of crime scene inspections already of high quality by systematic control activity, and to uniform nationwide the executive practice corresponding to international demands.

Department of Polygraph Examinations and Criminalpsychology

The Hungarian Police has introduced the polygraph into its forensic tool arsenal in 1978. Even the first utilization of instruments resulted in unexpected success, by the help of the new technique series of murder and missing person cases were solved. By the end of nineties the experts performed about 200 examinations annually, this number has reached the value of 500-600 by 2003 and has stood constantly on 350 since then. Besides th poligraph tasks, our criminalpsychologists perform about 133 examinations annually.



Central Bureau and Secreteriat

The Central Bureau and Secreteriat are the youngest departments of Institute. The main task of these departments is to provide the human, technical and financial sources needed for the basic activity of Institute dealing with the administration, the IT activity, the central documentation and the internal controlling. The Scientific Library as a part of the Bureau provides the wide range national and international technical literature not only for the scientists of Institute but for researchers of criminology and students and scientific workshops of universities, as well.