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**Research in  
Forensic Science  
and Technology**

U.S. Department of Justice  
National Institute of Justice

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Stockholm 1972

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✓ Report of a study on

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**RESEARCH IN FORENSIC SCIENCE AND TECHNOLOGY**

by

**The Forensic Science Committee of Swedish Research Councils  
and the National Police Board**

## INTRODUCTION

In the beginning of 1971 a committee was appointed with the task of making proposals for the improvement of research within forensic science and technology in Sweden.

The present publication is the committee's official report, which is translated from the original Swedish version.

The members of the committee have been:

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Swedish Board for Technical Development

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## 1. ORIGIN AND AIMS OF THE COMMITTEE

Basic scientific research results in new knowledge and skills. It is most important for human society that these results should without delay be utilised in the various fields they touch: in the economic sphere and in technology, in technical developments within the environmental, consumer and medical spheres, in criminalistics, and so on.

In this process of transfer a vital role is played by scientific research councils and corresponding bodies that support applied research and development work, and the executive organs in administration and business life whose function it is to utilise the results achieved. However, it is also most important that the research councils which primarily support basic research should follow the evolution of this transfer of knowledge and the complementary research connected with it, as well as take measures to make the entire process effective.

Criminalistics employ findings and techniques from the spheres of physics, chemistry, the geo-sciences and biology. One example of this is the so-called ninhydrin method, which was originally a standard technique used by biochemists for detecting protein but has now become routine throughout the world for developing fingerprints. Another example is activation analysis, which is based upon the utilisation of neutron radiation from an atomic reactor and permits elemental analysis of minute test samples. This has been used in many ways in criminalistics. About one year ago, the Swedish Natural Science Research Council (NFR) gave a grant to the Osteological Research Laboratory for study of the ultrastructure of the pattern of the horny sheath cuticulum of individual hairs. This was primarily basic research, since it opened up interesting prospects of coming to grips with the problem of determining the origin of hair from various animals, a technique which biologists have long sought for analysis of nutritional pathways and other purposes. With some further development the technique evolved by this study could become a very useful complement to other methods of identifying hair in criminalistics.

The pace of progress is fast in various areas of science and technology. The new methods and knowledge that are constantly being acquired can be adapted to the requirements of criminalistics to a much larger extent than they are at present. However, such adaption, if it is to be meaningful, demands research that is directed towards the ends in view. In this connection the National Laboratory of Forensic Science (SKL) should play an important role.

In a report entitled "Statens kriminaltekniska laboratorium" (National Laboratory of Forensic Science), issued by the Swedish Ministry of the Interior in 1963, a new type of organisation was proposed for the laboratory which at that time was called "Institute". This was finally decided upon in 1965 and included, inter alia, the provision that its director should have the

status of professor. with certain teaching duties in criminalistics at Stockholm University. Criminalistic research was to be one of the functions of the laboratory. but no particular research department was established.

The Swedish Natural Science Research Council (NFR) stated in its comment on the report mentioned above:

It is an old experience that when both routine and research work are to be carried out at the same institute. it inevitably happens that the routine work takes precedence over research. This is human and understandable and if it has become particularly noticeable in the institute under consideration it is because important and urgent case-work which is also often of great public interest. comes up rather frequently. Thus the staff is under heavy psychological pressure to give priority to the everyday assignments. It might have been expected that the present enquiry, which in principle is very positive to supporting research facilities, would have taken previous experience into account and made proposals for improvements, but this has not happened to any satisfactory extent. It is stated that the professor and director shall himself carry on research and that it is also highly essential that the staff be given the opportunity to pursue applied research and development work in the field of criminalistics.

However, one must unfortunately expect that this has as little chance of being realised within the National Laboratory of Forensic Science (SKL), organised in accordance with the proposals of the 1965 enquiry. as it had within National Criminalistic Institute (SKA). To remedy this situation the Swedish Natural Science Research Council (NFR) proposes that a special research department be set up under the direction of the professor which would from its inception consist of at least two or three graduates from universities or similar personnel. three to four technicians or laboratory assistants — and with the requisite laboratory space and basic apparatus. The details of this set up can hardly be described before the professor is appointed and his special sphere of interest ascertained. Both the kind of staff and apparatus will depend on this. At a little later stage an additional research post should be created on the level of an associate or assistant professorship, with the usual auxiliary staff. If the director's research department is provided with basic staff and general basic equipment it will always be possible to apply for special research projects grants for staff, equipment, study trips, and so on from the appropriate research councils. Most closely concerned will probably be the Swedish Natural Science Research Council (NFR), the Medical Research Council (MFR) or the Swedish Board for Technical Development (STU) and in certain cases perhaps also the Council for Social Science Research (SFR).

The establishment of a special research department, which has no duties whatever regarding the routine laboratory work, should guarantee that the research will not be just a matter of pretty words but also a reality.

Moreover, the resources available in other departments must be at such a level that their staff are also able to perform research in their particular fields.

The enquiry while proposing that the National Laboratory of Forensic Science (SKL) be established as an independent institute. also discusses the question of how adequate contact with the academic world can be developed. The conclusion is that this can best be done by giving the director professorial status with teaching duties in criminalistics at Stockholm University or the Royal Institute of Technology. From other statements in the enquiry it would seem that Stockholm University is preferable. It is also stated that the establishment of a professorship in criminalistics connected with the university should give an impetus to the retarded applied research and development work in the field of criminalistics. The holder of the professorship should also be director of an institution of this type. The setting up of such a professorship may also be expected to encourage some students to become interested in this new field on study.

The proposal of the Swedish Natural Science Research Council (NFR) to establish a special research department directly under the professor and director of the department accords well with — and is complementary to — the schedule set out in the enquiry. The research department should, in fact, function as a department of Stockholm University for the study of criminalistics. This institute and the professorship should come under the Faculty of Science, which would provide a channel for the expected flow of students through the department. The council considers this question of recruitment of academic staff to be of the highest importance both for the work directly connected with the National Laboratory of Forensic Science (SKL), and similar activities, such as the local technical units within the police organisation whether existed or planned.

The fears expressed by the Swedish Natural Science Research Council (NFR) regarding research in the National Laboratory of Forensic Science (SKL), have unfortunately proved to be only too well founded.

The post of professor and director of the criminalistic laboratory was filled in 1970. The Swedish Board for Technical Development (STU), the research councils concerned and the National Police Board (RPS), were thereby confronted by the immediate problems of establishing and furthering research at the National Laboratory of Forensic Science (SKL).

Therefore the Swedish Natural Science Research Council (NFR), which is responsible for supporting basic research in this area, and the Swedish Board for Technical Development (STU) which is responsible for supporting technical research and development work, decided to establish a committee with the functions specified below.

The committee has included representatives of:

The Swedish Board for Technical Development (Styrelsen for teknisk utveckling)

The Swedish Natural Science Research Council (Statens naturvetenskapliga forskningsråd)

The Medical Research Council (Statens medicinska forskningsråd)

The Council for Social Science Research (Statens råd för samhällsforskning)  
University of Stockholm

The Osteological Research Laboratory

The National Police Board (Rikspolisstyrelsen)

The National Laboratory for Forensic Science (Statens kriminaltekniska laboratorium)

The committee's functions have been:

1. To examine the possibilities of establishing a research group supported by the Swedish Board for Technical Development (STU) and the research councils concerned, in connection primarily with the National Laboratory for Forensic Science (SKL)
2. To propose other measures which the committee finds desirable for supporting research in this sphere.

The committee's administration expenses have been paid by the Swedish Natural Science Research Council (NFR) and the Swedish Board for Technical Development (STU).

## 2. THE CONCEPT OF FORENSIC SCIENCE AND THE COMMITTEE'S SCOPE OF OPERATIONS

In the wider sense the expression forensic sciences includes the application of scientific methods to legal problems. The scientific methods may be derived from natural science, medicine and technology, as well as from social science and the humanities. The diagram on the following page attempts to show in a very simplified form the main features of the relationships between these subjects. To this the committee adds the following comments:

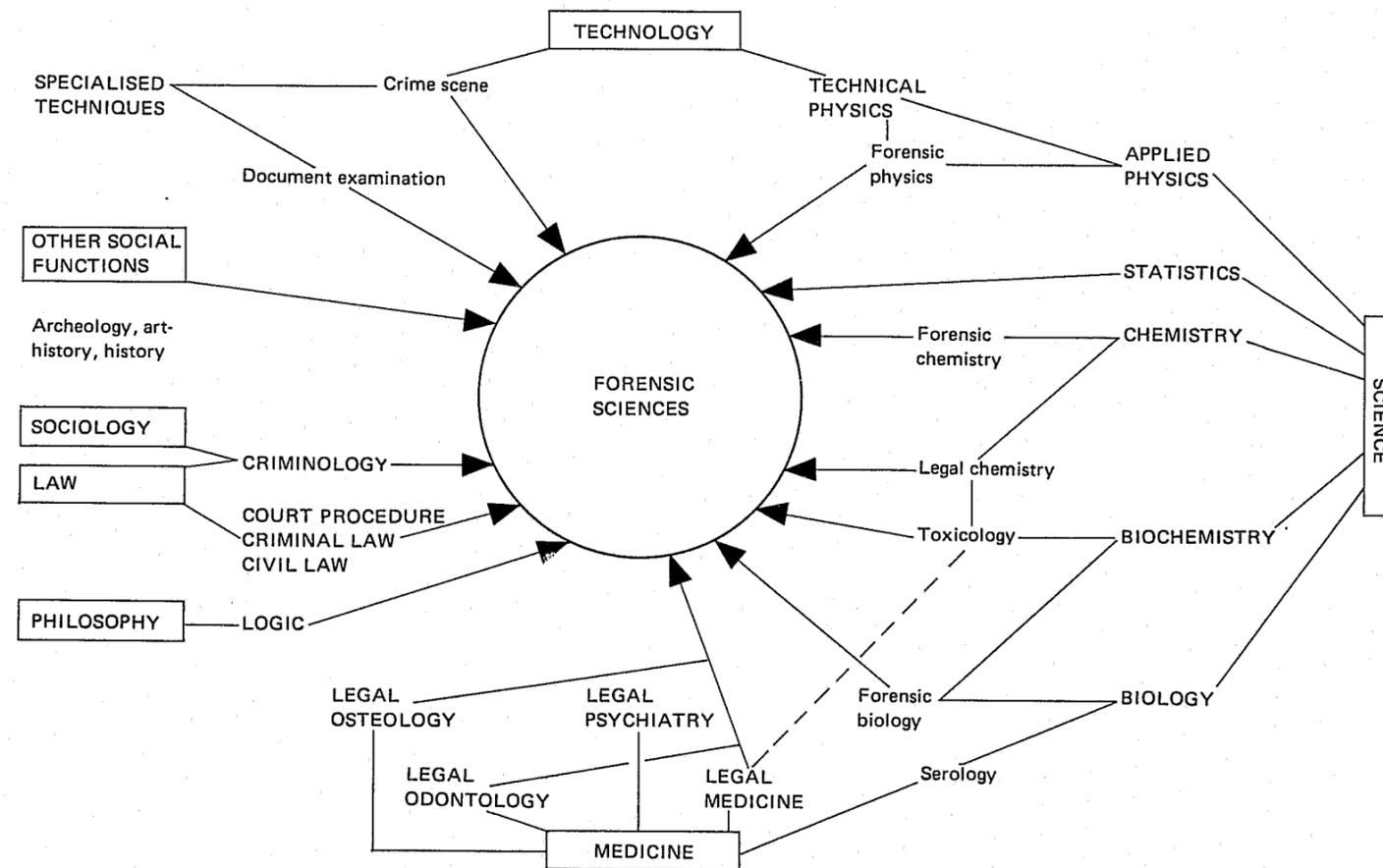
By forensic science and technology the committee means the application of scientific and technical research to the legal system and associated fields. Research in forensic science and technology may aim at creating technical means for scientific investigation in legal cases as well as for the prevention of crime.

In principle every scientific or technical subject dealing with the fields mentioned above may be classified as forensic. Thus one may speak of forensic physics, forensic chemistry, forensic biology, forensic electronics, forensic photogrammetry, etc.

Purely medical subjects such as forensic medicine, forensic psychiatry, and the clinical medical subjects are outside the scope of the committee's work.

In the borderline area between science and basic medical research, however, there is a number of subjects as serology, general osteology, microbiology and molecular biology, which are common to both natural science and medicine. A special borderline position is occupied by legal chemistry, partly because there exists a government institute working in this field, i.e., the National Laboratory of Forensic Chemistry (SRL). For administrative purposes the National Laboratory of Forensic Chemistry (SRL) comes under the National Board of Health and Welfare (Socialstyrelsen). In principle, and for historical reasons, legal chemistry is part of the field of forensic medicine. Developments in recent years, however, have given this branch of science an increasingly independent status. At the same time operations in the National Laboratory for Forensic Chemistry (SRL) have been divided among two institutes that are relatively independent of each other: a legal chemistry (or toxicological) institute in the strict sense (the present toxicological-chemical department) and a blood-group serological institute (the present blood-group serological department).

Certain areas of activity in the National Laboratory for Forensic Chemistry (SRL) and the National Laboratory of Forensic Science (SKL) are related as regards the methods of work employed. Thus the National Laboratory for Forensic Science (SKL) performs certain blood-group serological examinations as well as certain chemical analyses of narcotics.



The organisation of the National Laboratory for Forensic Chemistry (SKL) has recently been the subject of an enquiry by the board of social welfare. The enquiry is at present on circulation for consideration by the bodies concerned. The activities of this laboratory and the subject of legal chemistry are beyond the scope of the committee.

The item of forensic chemistry mentioned in the diagram relates to the activity of the National Laboratory of Forensic Science (SKL). This comes within the committee's scope.

The expression criminalistics denotes a combination of the technical and scientific facilities in criminal investigations.

The examinations carried out in laboratories and in the field when a crime is suspected are called criminalistic examinations. Examples of such examinations are given below in the section on the National Laboratory of Forensic Science.

The function of research in forensic science and technology is to supply new knowledge and new methods for use in criminalistics - i.e., to be a driving force in the development of criminalistics.

Criminalistics may also operate for the prevention of crime. This preventive criminalistics is separate from that area of criminology which denotes the techniques employed by society in its fight against crime, and which can be summarised under the heading of criminal policy even though there are certain points of contact. Forensic science research and technology may, however, be directly aimed at the development of methods and techniques for the prevention of crime. In periods when crime is increasing rapidly, intensified efforts in this area may prove necessary (see also the publication on the development of crime: *Brottsutvecklingen, 1970-1976*, published by the Swedish Department of Justice, 1971:19).

As mentioned in the diagram on page 14, certain social sciences also have points of contact with the forensic sciences, such as the utilisation by the police authorities, prosecutors and courts of the results of criminalistic examinations. As regards the legal background for the utilisation of such results in trials the following may be said:

Previously, the rules of court procedure could constitute an obstacle to the complete utilisation of criminalistic findings in a trial. During the Middle Ages and most of the time since then, the so-called "legal evidence theory" has been in force. This forbade the use of certain types of evidence and, moreover, the law specified that the value of the evidence presented was to be determined by the court. One example of this is found in the rules concerning objections to witnesses in the court procedure rules of 1734 and the statement therein that two unanimous witnesses shall be regarded as full evidence and that one witness is half-evidence. Now, however, Swedish law

recognises the principle of free evidence. This was already observed in practice before the present court procedure rules came into force in 1942. In Chap. 35, sec. 1, § 1, of this statute the legislators attempt to give clear expression to the principle of free evidence ("The Court shall, after carefully weighing everything that has happened, decide what may be regarded as proven in the case").

The principle of free evidence means primarily that no limitation is set as regards the nature of the material or the sources of information that may be used for investigation of the facts of the case. (A quite different matter is that the right to use compulsion in criminal investigation, such as detention and the search of premises is carefully regulated and that certain procedures — e.g., torture, are wholly forbidden). In the second place, the principle of free evidence means that the judge shall freely — but, of course, objectively — evaluate the evidence given before him. The court procedure under the 1942 rules is also such as to provide favorable conditions for the free evaluation of evidence. Thus, for example, it does not include the kind of restrictions on the right to present certain evidence which English and American law imposes for historical reasons with regard to the jury system and to the important role played by cross-examination in such procedures. Accordingly no requirement such as that which led the US Supreme Court to make provisions concerning investigations in criminal cases exists in our country. Here the field is open for the presentation of criminalistic and scientific evidence. Another matter is that the nature of free evidence evaluation has not been examined in any great detail. The manner in which the judge evaluates evidence is not entirely clear. An interdisciplinary research project on the examination of evidence evaluation in court has been in progress for the past year by a research group of legal, philosophical, logical-mathematical, statistical, pedagogical and psychological experts, supported by the Bank of Sweden Tercentenary Fund (Riksbankens jubileumsfond). This work may prove of value also as regards the utilisation of scientific and technical methods in court procedures.

The project includes: a) a legal examination of the manner in which evidence is evaluated, b) a psychological analysis of how the judge deals with the information before him and reaches his decision, and c) a logical-statistical examination of the underlying evidence structure.

Among these questions the logical-statistical evaluation of criminalistic findings has been of particular interest to criminalists. Comprehensive research in this field would be of great value for the presentation of technical evidence since certain contact problems of a semantic nature may arise between the scientist/technician and the jurist on this point.

A further aspect of the contact between criminalistic and legal experts has to do with the logical-statistical problem and the utilisation of the criminalist's report in court procedure. At present the National Laboratory of Forensic Science (SKL) possesses hardly any information regarding the

extent to which such reports are used in evidence. Nor is the Laboratory aware of the wishes of the courts, police authorities and prosecutors regarding the form of such reports, except in a few cases where special enquiries have been made. Concerning the cost of obtaining the services of criminalists, (The National Laboratory of Forensic Science's annual budget amounts to almost Skr 5 million — i.e., \$ 1 million), it would appear desirable to carry out "market research" in order — if possible — to improve the "product" — i.e., the expert reports.

A study of the significance of criminalistic expert reports in relation to court work will certainly be facilitated by the computer processing of court decisions in criminal cases which was started in October 1, 1970.

In view of the above, the committee is of the opinion that: social science research in the field of forensic sciences is of great value to the country's legal system and to the legal rights of the individual. The above mentioned study in the field of logical statistical evaluation of criminalistic evidence is an example of the valuable service which research is rendering the mandators in the legal system.

In this connection it should be pointed out that technical evidence of criminalistic type may also be used in civil cases. However, at present such evidence plays a minor role. The question of the significance and value of such technical evidence should therefore be examined.

To sum up, the committee's main spheres of interest may be delimited as follows:

1. To the forensic applications of science and technology (criminalistics)
2. To the criminalistic evidence evaluation in the social sciences
3. To the methodological research directed towards crime prevention.

### 3. PRESENT ORGANISATION OF RESEARCH AND EDUCATION IN SWEDEN

A central position in this connection is occupied by the National Laboratory of Forensic Science (SKL) (3.4). In addition technical police sections, which were later named technical divisions (3.2), were set up in every county, at the time of the nationalisation of the police system. Their main function is investigative field work. A certain amount of research and method development in forensic science and technology is carried out in departments attached to universities (3.3), chiefly as the result of requests for expert assistance from the National Laboratory of Forensic Science (SKL) in connection with the investigation of problems in serious crimes.

Instruction (3.4) in criminalistics is provided at Stockholm University. Moreover, the National Police Board's (RPS) police training school gives special courses in criminalistics.

#### 3.1 NATIONAL LABORATORY OF FORENSIC SCIENCE

##### 3.1.1 Historical background and organisation

The predecessor of the National Laboratory of Forensic Science (SKL) was the national criminalistics institute, established in 1939. This consisted of a registry division and a laboratory division. In 1953 a special Stockholm department was established within National Criminalistic Institute (SKA); in 1959 this department was detached from the institute and today it constitutes the technical division of Stockholm police district.

By way of introduction it was pointed out that in 1963 by order of the Ministry of the Interior a special enquiry report was issued concerning the organisation and functions of the laboratory department. The proposals therein, after submission to the usual bodies concerned, were submitted to Parliament as a bill (1964:100) and became law.

This meant that the laboratory department was reorganised and its name changed to the National Laboratory of Forensic Science, while the registry department of National Criminalistic Institute (SKA) was transferred to the new National Police Board (RPS).

The new National Laboratory of Forensic Science (SKL) is an independent unit with its own constitution laid down by law (SFS 1965:675, with subsequent changes); but for administrative purposes it is attached to the National Police Board which is the chief authority.

The principal tasks of the National Laboratory of Forensic Science (SKL) is to carry out criminalistic investigations and within its area to carry out criminalistic research. Following application to the National Police Board

(RPS) researchers other than those employed in the laboratory may under certain circumstances be allowed to carry out research in the laboratory within its fields of interest. The laboratory shall give priority to investigations requested by courts, prosecutors or police authorities.

The director of the laboratory has the status of professor. The laboratory includes three departments: a chemical and biological department, a technophysics department and a document examination department. These departments are divided into sections. Each department is headed by a department leader.

Appointments to the professorship and the leader of department posts are made by the Government on the basis of proposals by the National Police Board (RPS). Before the Board makes such proposals it shall obtain expert opinion concerning the scientific qualifications and competence of the applicants. As regards the professorship, two of the experts referred to shall be appointed by Stockholm University's Faculty of Science and one by the Royal Institute of Technology. Concerning the posts of leaders of department, the experts shall be appointed by the Office of the Chancellor of the Swedish Universities.

The director of the laboratory shall give instruction in criminalistics at Stockholm University and fulfil such functions in the area of criminalistics as the Chancellor of the universities may decide.

### 3.1.2 Present working conditions

At present, more than 60 staff members are in employment at the National Laboratory of Forensic Science (SKL). The laboratory's budget for 1971-72 amounts to Skr 4.5 million (about \$ 900.000), of which Skr 0.25 million (about \$ 50.000) are set aside for purchasing equipment, chemicals etc.

The laboratory, which is situated at Ekensbergsvägen 113 in Solna, has a floor area of 3.100 sq. metres (equivalent to about 40.000 sq. ft.).

In accordance with a decision of Parliament (1971:29) concerning the location of certain government offices the National Laboratory of Forensic Science (SKL) will be transferred to the town of Linköping.

Some idea of the typical routine work at the Laboratory may be obtained from the following list of constituent sections and their respective assignments:

Handwriting investigation section: Handwriting examinations on cheques, wills, anonymous letters, postal-orders, etc.

Document investigation section: Examination of forged banknotes, driving licenses, cheques, works of art, postage stamps, etc.

Weapons section: Identification of bullets, cartridges, firearms, explosives, damage caused by bullets, reconstruction of accidents and crimes in connection with firearms, etc.

General section: Comparative clue examination as regards tools, shoes, locks, parts of previously connected material, clothes, etc. Examination of gambling machines, forged coins, etc.

Fire investigation section: Examination of chemical, electrical, and mechanical fire damage. Determination of casus of fires and reconstruction of the course of fires.

Chemical section: Analysis of narcotics and poisonous substances (except in biological material from humans, in which case the National Laboratory for Forensic Chemistry (SRL) performs the analyses, and from animals, in which case the National Veterinary Institute does the examinations), paint flakes, glass, welding sparks, etc.

Biological section: Determination of blood groups, examination of sperm, hair, fibres, plant material (Cannabis, spices, tobacco, etc.), wood, etc.

Photographic section: Photographic service work for the other sections. Photography in ultra-violet and infra-red light, colour photography, microphotography.

Library: Handling of current periodicals (approximately 80) dealing with subjects of interest to the laboratory. Purchase and collection of books (about 5.000 volumes, some of them unique in the country) and borrowing of books from other libraries.

It is difficult to describe the National Laboratory of Forensic Science's (SKL) workload in statistical terms. Certain tasks can be performed in about one hour while others may require hundreds of working hours. The latest statistics available relate to 1969 and 1970 and are shown in the following table:

Department	Number of cases	
	1969	1970
Chemical and Biological	1630	1726
Physical-Technical	540	563
Document Examination	380	435
Total	2550	2724

Certain tasks in the weapon section and the general section are similar to those in the technical divisions in Stockholm, Göteborg and Malmö, which are large and particularly well-equipped.

The examinations carried out at the National Laboratory of Forensic Science (SKL), however, are generally of a more advanced nature. As there are no experts on some subjects (hand-writing, document examination, chemistry, biology and serology) in the police technical divisions, examinations in these fields are carried out at the Laboratory. Chemical and serological analyses of a forensic nature are performed both at the National Laboratory of Forensic Chemistry (SRL) and the National Laboratory of Forensic Science (SKL).

In all sections great efforts are made to keep up with developments in the respective fields by study of the specialised literature. Some method development work is also done.

Since its establishment, the laboratory has been entirely occupied with criminalistic investigations arising from current criminal cases, and as a result the criminalistic research activities assigned to it under the regulations (see page 19) have had to be deferred to a great extent.

### 3.2 TECHNICAL DIVISIONS OF THE POLICE ORGANISATION

In each of the 24 counties there is at least one so-called technical division (29 in all). These divisions deal with technical examinations primarily in serious criminal cases of where such crimes are suspected. The technical examinations comprise those made at the scene of the crime or the fire as well as reconstruction and investigation work. The divisions also carry out a certain amount of laboratory work.

The technical division in Stockholm police district is the largest and employs about 40 persons. It operates on both local and national levels. The national level activities are directed by the National Police Board (RPS) via the so-called national criminal division (Rikskriminalen) in the criminal section of the board. The scene-of-the-crime investigator is thus a member of the Stockholm district technical division.

The work of the technical divisions is mainly a matter of practical criminalistics. These divisions are therefore, the chief "customers" for the findings obtained by research in forensic science and technology and are an important source of encouragement for this research.

### 3.3 DEPARTMENTS AT UNIVERSITIES

For special investigation assignments the National Laboratory of Forensic Science (SKL) obtains the services of experts at universities, public authorities, business firms, etc. This involves a total of about 100 experts at special institutions. Some of these are located abroad. However, no continuous research in the area of forensic science and technology is carried on at any of the Swedish institutions in question.

### 3.4 INSTRUCTION IN CRIMINALISTICS

These instructions which, according to the regulations, the director of the National Laboratory of Forensic Science (SKL) shall provide at Stockholm University, comprises lectures and seminars in the Faculty of Law and in the Faculty of Science.

This instruction has aroused great interest. In the subject of law of court procedure there has been some increase in the amount of instruction provided in criminalistics, and the students have asked for a further increase. In the subject of forensic chemistry a Ph. D. course has been arranged for the autumn term in 1971. Because of the large number of participants it is expected that the course will be repeated in the spring term of 1972. The course consists of 10 hours of lectures and 12 hours of demonstrations, of which six hours are given at the National Laboratory of Forensic Science (SKL). The instruction given by the director of the Laboratory amounts to about 32 hours per academic year.

At the other universities in Sweden no instruction is given in criminalistics, with some minor exceptions.

The staff of the National Laboratory of Forensic Science (SKL) are also involved in educational work at the national police schools in Solna and Ulriksdal and in the courses for public prosecutors. The National Police Board (RPS) arranges a special course in criminalistics for the staff of the technical divisions. The purpose of this 12-week course is to train the personnel concerned in scene-of-the-crime and cause-of-the-fire examinations.

Since 1963, the special course in criminalistics has been supplemented by a series of lectures and exercises given by the osteological research group (1963-1967), later known as the Osteological Research Laboratory in Solna (from 1967) under the title of "Scene-of-the-crime examinations from the osteological viewpoint" (maximum 12 hours) and also in connection with the course in cause-of-the-fire investigations, entitled "Identification of charred bodies" (4 hours). During the past two years both these series of lectures have also been given in highly condensed form (4 hours) to participants in the police commissioner and police-chief courses at the police schools.

#### 4. THE ORGANISATION OF RESEARCH AND INSTRUCTION ABROAD

In the following section the committee confines itself to certain countries where special efforts are made to promote research and instruction in the field of forensic science and technology. No detailed survey of these seems necessary for the relatively limited purposes of the committee.

The following account is based on material gathered by a committee member, Professor A. Machly, during a tour of the leading criminalistic laboratories in Western Europe, and on certain other material obtained by the committee.

In some countries (e.g., U.S.A., Canada, United Kingdom and Poland) there exist special coordinating bodies with advisory and grant-awarding functions and with the further duties of promoting research and development work and instruction in the fields of forensic science and technique. The account will begin with these countries (4.1 - 4.5). This is followed by a short description of the criminalistic laboratories in Paris (4.6) and in The Hague (4.7).

##### 4.1 UNITED STATES OF AMERICA

###### 4.1.1 Law Enforcement Assistance Administration (LEAA)

The increase in crime in the U.S.A. at the beginning of the 1960's led to the establishment of a special Commission on Law Enforcement and Administration of Justice. The committee published its principal report in 1967. This proposed the establishment of the Law Enforcement Assistance Administration (LEAA) directly under the Department of Justice. The Law Enforcement Assistance Administration (LEAA) came into operation in 1969.

Its functions are as follows:

1. To participate in the formulation of detailed plans for the fight against crime in the various states of the union
2. To make grants for the carrying out of these plans
3. To promote research and development work for the fight against crime

For the year 1970, Law Enforcement Assistance Administration (LEAA) had \$ 263 million at its disposal. About half of this sum consisted of "Action Grants"-i.e., direct grants for the purpose of obtaining equipment. The grants for research and instruction amounted to \$ 26 million.

#### 4.1.2 National Institute of Law Enforcement and Criminal Justice

For research work Law Enforcement Assistance Administration (LEAA) has established a special body, known as the National Institute of Law Enforcement and Criminal Justice. This may be regarded as a research council with grant-awarding and coordinating functions in the field of criminalistics. The Institute's sphere of operations is extensive and its staff includes experts from the fields of science, technology, medicine and social sciences. In 1969 the Institute employed 35 such experts and 15 administrative officials.

The functions of the Institute are divided among five so-called Research Centers, namely:

- Center for Crime Prevention and Rehabilitation
- Center for Criminal Justice Operation and Management
- Center for Law and Justice
- Center for Special Projects
- Center for Demonstration and Professional Services.

The sum of \$ 26 million which Law Enforcement Assistance Administration (LEAA) granted in 1970 for research and instruction included an approximately \$ 7.5 million budget for the National Institute of Law Enforcement and Criminal Justice.

The Institute's projects include seven recently-begun research and criminalistic projects, and a number of similar research studies are planned.

The seven projects referred to, which are located at universities, or special laboratories independent of universities, are as follows:

##### Study of criminalistic activities

1. Type and number of physical clues at scenes of crime and statistical treatment of these clues as evidence.
2. Optimal organisation of criminalistic activity for various geographical areas (entire country, state of the union, county, etc.).

##### Blood tests

3. Reconstruction of accidents and crimes on the basis of the position and location of blood stains and blood spattering.
4. Introduction of electrophoretic methods for the determination of different serum groups of blood.
5. Development of routines for determination of a number of specific factors in dried blood, in addition to the ABO system.

#### Determination of elements as principal constituents or trace elements

6. Evaluation by means of neutron activation analysis of the following: gun-powder traces, paint flakes, paper, lead in bullets, particularly with regard to the statistical basis of conclusions and reports.
7. Comparison between and evaluation of inorganic mass spectrometry (spark-source mass spectrometry) and neutron activations analysis in forensic work.

As regards future research work, the following proposals have been made:

Development of a report system concerning the contributions of criminalistics to the legal system which would feed back information to them. Such information could facilitate the organisation of criminalistic work and be of value for the planning of research.

Evaluation of various organisational set-ups for criminalistic work (laboratories for routine work, mobile laboratories, criminalistic institutes, etc.).

Development of an automated one-finger system for dactyloscopy.

Development of methods for effective serial analysis of narcotics.

Computer-processing of clues obtained in scene-of-the-crime investigations.

#### 4.1.3 Law Enforcement Education Programme

This programme, which in 1970 had a budget of about \$ 18 million, also comes under the Law Enforcement Assistance Administration (LEAA). The aim of the programme is to provide further education for police and legal personnel by means of academic studies at universities and colleges. The grants available are divided among the various educational institutions by a National Advisory Committee which consists of 12 members representing the police and prosecutor authorities, the Federal Bureau of Investigation, and others. Apportionment of the individual grants or fellowships is made through the educational institutions concerned.

#### 4.1.4 Federal Bureau of Investigation (FBI)

A considerable amount of research and development work in criminalistics is carried out by the Federal Bureau of Investigation (FBI). This organisation dates back to 1908, but the Federal Bureau of Investigation (FBI) in its modern form was created in 1924. Subsequently, it became necessary to provide more instruction for the staff, and for this purpose the Federal

Bureau of Investigation (FBI) established various facilities, including instructional units for criminalistics in Washington. It became evident that for the proper functioning of the organisation it was necessary to have access to criminalistic laboratories with qualified university-trained staff. The Federal Bureau of Investigation (FBI) laboratories for carrying out routine examinations and other assignments of the types referred to are the largest of their kind in the world.

#### 4.1.5 Development and research work on the State level

Apart from the research and development carried on by federal authorities a not inconsiderable amount of such work is done by the various State police organisations, and relatively often in co-operation with the local and higher educational institutions e.g., in New York. This work is coordinated by a number of more or less official bodies. These include the National Research and Information Center on Crime and Delinquency, the American Society for Criminology and the American Academy of Forensic Sciences. The latter also publishes a periodical, the Journal of Forensic Sciences.

#### 4.1.6 School of Criminology of the University of California

In the field of teaching and research in Forensic Sciences, the School of Criminology of the University of California, plays a leading role in the United States. Regular courses for the degree of B.Sc. began there in 1933, and since 1947 it has also been possible to obtain a M.Sc. The School of Criminology has in many respects provided a pattern for the academic courses and programmes later initiated at other seats of learning. The aim of the School of Criminology courses is to train personnel for the multifarious assignments in the modern legal system – including criminalistics. Research is also performed at the School in various specialities e.g., forensic science and technology. This research, which is supported by contributions from Law Enforcement Assistance Administration (LEAA), aims at providing a basis for crime prevention measures and at the development of criminalistic methods of analyses.

The U.S.A. is one of the leading countries as regards criminalistic research and instruction. This is largely because the subject was included at an early stage in the curricula of some universities and colleges. Qualified staff are available and contact with research institutions has done much to promote the rapid development of scientific methods and technical apparatus for crime prevention. A further positive factor has been the establishment of special bodies on federal level for the purpose of coordinating and furthering development in the fields of research and instruction and the fact that these have been granted considerable resources for their operations.

#### 4.2 CANADA

In the province of Ontario, which has about the same number of inhabitants as Sweden, an institution was established in 1966 (following a certain amount of reorganisation) entitled The Center of Forensic Sciences, Ontario (CFSO).

Its aims are defined as follows:

1. To apply the principles of forensic science to assist in law enforcement and the administration of justice in the Province of Ontario.
2. To conduct, direct and promote education programmes in forensic science for law enforcement and administration of justice officers, officers of the Courts and faculties of medicine, science and law in close cooperation with the administration of the universities.
3. To conduct and promote research programmes in forensic sciences.

The Center of Forensic Sciences, Ontario (CFSO) is thus to some extent a research advisory body with the function of promoting research. The Center of Forensic Sciences, Ontario (CFSO) is administered by a board that is directly responsible to the Public Safety Division of the Department of Justice. The board includes the chief of the institution, an official of the Department, a coroner, two pathologists, a pharmacologist, the provincial chief of police, and a professor of medicine.

At present The Center of Forensic Sciences, Ontario (CFSO) has about 80 employees in the following sections:

- administration
- pathology (autopsies are also performed)
- toxicology
- biology
- chemistry (fire investigations and technophysical examinations are also performed by this section)
- document examination
- weapons
- photography.

These sections on the whole correspond to a combination of the functions of the National Laboratory of Forensic Chemistry (SRL) and the National Laboratory of Forensic Science (SKL) in Sweden. This combination of functions within the same institution is considered to be very advantageous.

The 80 employees include 5 Ph.D.s, 2 M.D.s, 10 M.Sc.s and 29 B.Sc.s (or the equivalent), i.e., more than half of the staff have university degrees.

Examinations are performed free of charge for what are called "official investigative bodies" including counsel of defense in criminal cases; others must pay for the services of the institution.

The number of criminalistic examinations performed is about the same as at The National Laboratory of Forensic Science (SKL) (more than 2.000 of a total of 7.000 assignments per year). Of these only about 10 per year concern civil cases.

The staff members give evidence before the court in about 600 cases each year, which is far more than the corresponding number in Sweden, where court appearances are exceptions.

Research and development work is carried on in various areas, including the following:

- Blood stains: Examinations relating to the isoenzyme systems, phosphoglucomutase and adenykinase, differentiation of the A<sub>1</sub> and A<sub>2</sub> subgroups in the ABO system and introduction of the MN system.
- Hair examinations
- Analysis of soil samples
- Collection and analysis of glass fragments
- Analysis of automobile paint
- Preparative gas chromatography for toxicological analyses.

Instruction is for the present limited to a course for legal personnel.

#### 4.3 ENGLAND

Note: The remainder of the United Kingdom has a different organisational set-up.

##### 4.3.1 Advisory bodies in the field of forensic science (HOSAC, FSC and PEC)

The Scientific Advisory Council (HOSAC) falls under the Home Office and consists of a number of leading academic researchers in many fields, a researcher connected with industry, and one or more higher officials with experience of forensic research and forensic problems.

Home Office Scientific Advisory Council (HOSAC) has two subcommittees, namely the Forensic Science Committee (FSC) and the Police Equipment Committee (PEC). These have only advisory functions. Research projects are financially supported by The Chief Scientist, Home Office. The latter has also been responsible for the establishment of research scholarships in forensic science, and at present two or three grantees (Senior and Junior Research Fellows) are working at the criminalistic laboratories in London and Aldermaston (see below).

The Forensic Science Committee (FSC) acts as advisor to the Home Office for the so-called Forensic Science Laboratories. These are regional bodies

— at present 8 in number — which perform criminalistic examinations. The limited resources of the laboratories hardly permit of anything in the nature of research.

The Police Equipment Committee (PEC) is the advisory body for technical and scientific development within the police authorities' area of operations.

##### 4.3.2 Metropolitan Police Forensic Laboratory (MPFSL), London

This laboratory is formally a part of the London police organisation. In practice, and particularly as regards the scientific and criminalistic work, the laboratory is on an equal footing with the other 8 regional forensic laboratories in England under the Home office. Most of the applied research is concentrated at the Home Office Central Research Establishment in Aldermaston (see below).

The chief of the Metropolitan Police Forensic Laboratory (MPFSL) has teaching duties at the University of East Anglia and the Detective Training School.

At present the laboratory employs about 130 persons, of whom half have various university degrees. Several staff members teach at the University of Liverpool. The staff is allowed a certain amount of leave of absence for further training.

The laboratory is mainly concerned with carrying out examinations on request. Some method research is also done.

At present this takes three forms:

1. Outside contracts — i.e., research on request by other institutions
2. Theses by laboratory staff at various universities
3. Method research in the laboratory, which constitutes most of the research done.

The method research in serology is internationally reputed. Good work is further being done in toxicology and x-ray diffraction analysis. Promising systems for information and statistical examinations are also being developed. Least developed at present are the weapon and handwriting examination sections.

##### 4.3.3 Home Office Central Research Establishment (CRE), Aldermaston

This laboratory is exclusively concerned with applied research in forensic science and technology and it accepts no examination assignments. So far as

the committee is aware this is the first and only institution in the world that is exclusively engaged in forensic science research. It was founded in 1967 following two decades of enquiries and discussions.

The Home Office Central Research Establishment, (CRE) employs 37 persons, of whom 20 have the degree of Ph.D., or equivalent. The present chief is a member of the Home Office Scientific Advisory Council (HOSAC) and chairman of the Forensic Science Committee (FSC).

The laboratory has 4 departments: Information, chemistry, toxicology and biology.

An important feature of the Home Office Central Research Establishment, England (CRE) is its information service. About 1 000 periodicals are reviewed manually and by means of electronic computer processing, and abstracts are dispatched each month in the form of lists and microfilms to the nine regional laboratories, including Metropolitan Police Forensic Laboratory (MPFSL). The information service also possesses a collection of chemical and physical data concerning pharmaceutical products and narcotics (infra-red spectra, ultra-violet spectra, chromatographic properties).

This collection is kept up-to-date and distributed in the form of microfilm cassettes to the regional laboratories.

Statistical processing of criminalistic analyses (e.g., glass, paint flakes, hair) is performed by a desk-computer. Talks and lectures are recorded on TV-video tape for use in police schools, local and regional laboratories, universities, etc.

The research is mainly done in the laboratory, but also through "outside contracts". This also applies to the construction and development of new apparatus and specialised instruments at various industries.

The research projects include:

- determination of carbon monoxide in the blood
- analysis of glass samples by means of inorganic mass spectrometry
- statistical processing of paint flake analyses
- microspectrophotometry (at present discontinued)
- spectroscopic analysis by means of laser (not yet begun)
- neutron activation analysis of glass and paint samples
- analysis of Cannabis sativa as regards its principal components (gas chromatography)
- pyrolysis gas chromatography of paint flakes and textile fibres
- analysis of LSD by means of spectrophotofluorometry
- blood examination to determine presence of isoenzymes (i.e., forensic serology)
- automation of toxicological analyses of human tissues, identification of menstrual blood, etc.

Hitherto about 50 scientific papers have been published by Home Office Central Research Establishment (CRE).

Home Office Central Research Establishment (CRE) was visited during 1969-1970 by 14 leading foreign researchers. During the same period 8 seminars and demonstrations were held. In the 4 years following its establishment Home Office Central Research Establishment (CRE) has gained valuable experience concerning the organisation of research work.

One problem that has not altogether been solved is the transfer of the results of research from Home Office Central Research Establishment (CRE) to the various local forensic laboratories. One of these, the Home Counties Forensic Science Laboratory, is housed in the same building as Home Office Central Research Establishment (CRE) and would appear to have excellent opportunities for contact with it.

#### 4.3.4 Instruction and Research Leadership

At the University of Strathclyde in Glasgow, Scotland, M.Sc. and Ph.D. courses in forensic science are provided. Following the B.Sc., a further year of study is required for the M.Sc., and a further two to three years for the Ph.D. In England there are no corresponding courses.

The qualified staff at the two laboratories, Metropolitan Police Forensic Laboratory (MPFSL) and Home Office Central Research Establishment (CRE), are recruited mainly among chemists, physicists and biologists with university degrees (M.Sc. or Ph.D.). They receive further training at the laboratories.

More recently, certain experienced staff members at Metropolitan Police Forensic Laboratory (MPFSL) have been authorised to direct the research projects of younger graduates who are studying for their M.Sc. or Ph. D. In this case the graduate comes under the guidance of an internal supervisor at the laboratory and an external supervisor from a university. The main responsibility for leading this work falls on the former, but the latter participates in the joint discussions one or more times during each term.

At present the University of London recognises Metropolitan Police Forensic Laboratory (MPFSL) as "an institution where research for the degrees of M.Sc. or Ph.D. may be carried out". Similar recognition has been granted in certain cases by King's College (London), Children's Hospital (London), the University of Wales and other institutions.

The director of the Metropolitan Police Forensic Laboratory (MPFSL) and certain other qualified staff members are entitled to act as supervisors for graduate students who are working on their theses at the laboratory. Two such projects are at present in progress.

The director of the Metropolitan Police Forensic Laboratory (MPFSL) is the only forensic scientist in England who is a member of a university faculty (in this case, Visiting Professor of Chemistry at the University of East Anglia).

At Home Office Central Research Establishment, (CRE) in Aldermaston at least one graduate has done his Ph.D. thesis (at the University of Aston) under the supervision of a staff member.

The types of instruction and supervision here described provide interesting examples of cooperation between the university and research units outside the ordinary university organisation. This type of cooperation has also been discussed in Sweden where certain measures are now proposed along these lines to promote the training of researchers.

#### 4.4 POLAND

##### 4.4.1 Coordination of research and development work

The Ministry of the Interior has a scientific council which examines research plans and awards grants for method development and applied research. Basic research is financed by the national scientific and technological committee.

Proposals concerning method development and applied research are made in cooperation with the scientific council at the criminalistic institute in Warsaw (see below) and in the Ministry of the Interior. The project in question is submitted to the department's scientific council for final decision.

The following current projects may be mentioned by way of example:

1. Development of infra-red microscopy for document examinations
2. Utilisation of computers for finger print registration
3. Development of a voice identification technique.

##### 4.4.2 Institutions for criminalistics and related subjects

These include:

- The Criminalistic Institute in Warsaw
- County police criminalistic laboratories
- The criminalistic sections in Faculties of Law.

The leading organisation in the field of criminalistic research and development is the Criminalistic Institute in Warsaw. This comes directly under the Ministry of the Interior, and its functions include:

1. Carrying out criminalistic examinations and making reports for judges, prosecutors and police authorities
2. Carrying out research and development work in its area of operations
3. Publication of a scientific periodical entitled "Criminalistic Problems"
4. Educational activities.

The laboratory includes investigation units in physics-chemistry, biology, weapons, etc. There is also a library, office and workshop, and an editorial office for criminalistic publications.

The institute includes a scientific council. This consists of the director of the institute and his two deputies, the department leaders and consultants, and a representative of the institute of legal experts in Cracow.

The board of the institute consists of the director and his two deputies. More than 100 persons work at the institute, including 70 researchers and experts.

##### 4.4.3 Instruction

The criminalistic laboratory in Warsaw trains experts in criminalistics. The course consists of 10 months' instruction in criminalistics, legal medicine, court procedure and criminology. Participants in this course must have higher technical or medical qualifications.

#### 4.5 LABORATORIE D'IDENTITÉ JUDICIAIRE IN PARIS

This is the principal criminalistic laboratory in France. In addition to the management of the laboratory, the director is professor of legal medicine at the Sorbonne University. He is also associated with the Institut de Criminologie at the Faculty of Law of the same university. The director gives courses for persons studying for the offices of prosecutor and judge and for the staffs of the regional police laboratories. Apart from the director the laboratory staff consists of 24 persons. Five of these have attended universities of leading colleges. The remaining staff consists of technical assistants who are mainly recruited from the police.

The laboratory performs examinations on request from official investigative bodies from all over the country, but issues written reports only to the courts - i.e., not to the police or the prosecutors.

Research work is carried out at the laboratory only to the extent permitted by the daily routine; it is therefore rather limited.

The research projects include:

- examination of paint flakes and glass by means of electronic probe technique and x-ray fluorescence
- dust analysis with an electron microscope
- examination of ball-point pen crossed lines by foil prints
- analysis of paintings and antiques
- finger print techniques.

Since 1964 about 20 scientific papers have appeared. Leave of absence may be obtained for further education and the preparation of theses at universities and colleges.

It should be noted that at the Sorbonne University there is no regular department of forensic science and consequently no research in this area.

#### 4.6 HET GERECHTELIJK LABORATORIUM (GL) IN S' GRAVENHAGE (THE HAGUE)

This laboratory comes under the direct administration of the Netherlands Department of Justice and is thus not a part of the police system.

In many ways Het Gerechteleijk Laboratorium (GL) is a combination of a criminalistic and a legal chemistry laboratory. Het Gerechteleijk Laboratorium (GL) thus carries out alcohol analyses in connection with cases of suspected drunken driving, toxicological analyses for the institute of legal medicine located in the same building, chemical analyses, legal serological analyses, handwriting and document examinations and – from 1972 – also weapon and tool examinations.

The director of the laboratory is also professor of forensic science at the Leyden University, Faculty of Law.

He teaches this subject also at the Universities of Utrecht Gröningen, Nijmegen and Amsterdam. These lectures are mainly intended for judges and prosecutors.

The laboratory at present employs 30 persons, of whom 12 hold university degrees. "Staff members" teach at the police school.

Het Gerechteleijk Laboratorium (GL) carries out a certain amount of work in method development parallel with its service activities. The examinations of both genuine and forged paintings carried out by the laboratory are well known. The handwriting department was the first in the world to routinely use statistical analysis. For the past year, laser spectroscopy for analysis of – e.g., paint flakes, glass, welding sparks and ball-point ink has been in use. Research is being done with x-ray diffraction and particularly x-ray fluorescence (for determining the distance from which a shot is fired, analysis of glass, paint and synthetic fibres). Pyrolysis gas chromatography

is used for analysis of paint and textiles. A registry of pyrograms of automobile paints is being established. Comparative analyses of Cannabis resin is performed by means of gas chromatography, partly in connection with mass spectrometry. LSD is analysed before and after ultra-violet radiation. A toxicological method is being developed for the extraction of freeze-dried tissue. Scientific thesis work is not done at the laboratory.

No courses in forensic science are provided at universities in the Netherlands, nor do research departments of forensic science exist at present.

#### 4.7 SUMMARY OF REPORTS FROM STUDY VISITS OF THE CRIMINALISTIC LABORATORIES IN WESTERN EUROPE

Of the laboratories mentioned above, the following have been visited by a member of the committee, Professor A. Maehly:

London: Metropolitan Police Forensic Science Laboratory (MPFSL)

Aldermaston: Home Office Central Research Establishment (CRE)

Paris: Laboratoire d'Identité Judiciaire

The Hague: Het Gerechteleijk Laboratorium (GL)

The experience derived from these study visits suggests that research in forensic science and technology should be carried out in close collaboration with the criminalistic field and laboratory investigators. Research at a criminalistic institute, however, should not be done parallel with the case work. It should be organised on a separate basis otherwise the research might be continually interrupted by routine work, thus preventing rational planning and effective carrying out of research projects. It is also most important that the researchers at such an institute should maintain close contact with researchers and teachers at universities and colleges. At the laboratories visited this was managed by having the director of the laboratory, and in certain cases the leading laboratory specialists, attached to or connected with a university or college for teaching and possibly also for research supervisory duties.

## 5. PROPOSALS

A good general idea of the scientific and technical research carried out in Sweden may be gained by studying The Swedish Board for Technical Development's (STU) and The Swedish Natural Science Research Council's (NFR) summaries concerning grants awarded. A perusal of the projects<sup>1)</sup>, however, reveals no grants to projects expressly for research in the field of forensic science and technology. This does not preclude the existence of grants to projects of a forensic nature, where this is not stated in the title of the grant. However, such instances are probably few. So far as The Swedish Natural Science Research Council (NFR) is concerned only one such case is known to the committee viz. the grant (mentioned in the introduction) to the Osteological research laboratory for the study of hair samples.

The Biomedical Documentation Centre at the Caroline Institute, Stockholm, has carried out a series of literature searches for the committee, concerning the amount of Swedish original scientific work on forensic chemistry and biology. These searches have, however, yielded nothing of interest.

The result of these investigations added to the committee's general knowledge of the situation lead to the conclusion that in Sweden research in forensic science and technology is very limited. A research vacuum thus exists where, in principle, any new research might be of interest. In this situation the measures taken to stimulate research, their nature and the force with which they are implemented, are more important than the subject matter, even though the latter can obviously not be disregarded. These considerations were the basis for the committee's proposals outlined below. The proposals are mainly of two kinds - those which The Swedish Board for Technical Development (STU), the research councils and the National Police Board (RPS) have power to carry out (5.1) and those which are beyond the authority of these bodies, but which they can refer for decision to other authorities and organisations or to the government (5.2).

### 5.1 MEASURES PROPOSED TO THE SWEDISH BOARD FOR TECHNICAL DEVELOPMENT (STU), THE RESEARCH COUNCILS AND THE NATIONAL POLICE BOARD FOR DECISION

The following proposals by the committee concerning measures for expansion of facilities involve the establishment of a research group (5.1.1), a scholarship programme (5.1.2) and a committee for forensic science and technology (5.1.4).

Moreover, the committee proposes certain guiding principles for Scandinavian and international cooperation in this field (5.1.3).

1) For The Swedish Natural Science Research Council (NFR), this search has been carried out for the years 1968 - 1971; For The Swedish Board for Technical Development (STU), for the year 1970 - 1971.

### 5.1.1. Research group in forensic science and technology

#### 5.1.1.1 Procedure for the establishment of councils research groups

An effective procedure employed by The Swedish Board for Technical Development (STU) and the research councils when starting new research projects and extending those in progress is to organise and finance a research group in the field in question with a qualified researcher of at least assistant professor status (docent) as director. At the The Swedish Natural Science Research Council (NFR) there are at present about 50 such groups which have been established and developed over a period of about 10 years.

The function of the directors is to carry out research in their subject- or project-area. Moreover, they must as a rule, provide a certain amount of instruction and supervision at the doctorate level.

As regards the number of personnel, the size of these research groups varies somewhat from one case to another depending on the basic resources of the parent institutes, the nature of the project etc. Apart from the director, whose competence is generally evaluated by experts, the larger experimental groups normally consist of a couple of assistants and two or three technical aides. Salaries amount to about Skr. 250 000 (\$ 50 000) a year. Moreover, expenditure for supplies and travel is about Skr. 50 000 (\$ 10 000) a year. Thus the total cost of such a research group may amount to Skr. 300 000 a year. In some cases the costs may be shared by several research councils. Working premises are provided for the research groups by the university concerned. The group is assigned to what is considered the most suitable institute, taking into account the nature of the project, equipment available etc. A written agreement is set up on this point between the council on the one hand and the university on the other.

#### 5.1.1.2 Research group at The National Laboratory of Forensic Science

On the basis of the council's very favorable experience with research groups as a means of promoting research in particular areas, the committee considers that the most effective measure toward initiating research in the field of forensic science and technology, is the establishment of such a group.

The most natural location of the group is at The National Laboratory of Forensic Science (SKL), where a close contact exists with practical criminalistics which is a prerequisite for the successful development of the group. Also available at the Laboratory is a considerable amount of basic equipment of different kinds, although the routine work does not always permit its use for research purposes. It may be added that the present director for the Laboratory has the necessary qualifications for directing scientific research.

### 5.1.1.3 Scientific aims of the research group

The choice of scientific objectives for the research group is to some extent affected by the fact that the present director of the National Laboratory of Forensic Science (SKL) has a chemical and biochemical background. From the Laboratory's viewpoint it is therefore desirable that the group should be lead by a physicist with at least assistant professor (docent) status under the over-all leadership of the director of the Laboratory. Thus the main areas of forensic science and technology can be covered by competent scientists. The physics and computer aspects of the work can probably be guided directly by the head of the research group, while subsequent chemical and biological projects could be carried out within the area of interest of the director of the Laboratory.

As regards the group's more specialised functions within the area of forensic physics, the committee believes that there exist a number of important research assignments in this field. Further development of scientific and technical methods for use in criminalistics and ideas for new projects of the same type, are coming in constantly. The following are a few examples of applied research projects of this kind which the group may undertake:

#### Applied research projects using physical methods:

<u>Method</u>	<u>Use</u>
X-ray fluorescence (excitation with primary x-rays, with electrons or protons)	Elemental analysis of small particles (paint flakes, welding sparks, metal chips, possibly glass)
X-ray diffraction	Analysis of soil samples (after fractionation), dust samples, cosmetics, plaster, paint pigments, etc.
Photogrammetry and holography	Survey of scenes of accidents and crimes, topography of small objects
General laser technique	Holography, emission spectography, pyrolysis gas chromatography, infrared spectrophotometry
Scanning electron microscopy	Topography of small objects (parts of plants, crossed lines in handwriting, tool marks, severed parts of objects which can be rejoined)
Spark-source mass spectrometry	Analysis of elements in glass, paint flakes, textile fibres, etc.
Fourier transform infra-red spectrophotometry	Taking of infra-red spectra of fractions separated by gas chromatography
Neutron activation analysis	Analysis of elements in metal flakes, gun powder traces and possibly hair

<u>Method</u>	<u>Use</u>
Monochromatic TV technique (as a complement to filter photography)	Examination of documents (cross-outs, erasures, etc.) and stains of various kinds
High-speed photography	Study of course of events in shootings and explosions
Electronic voice analysis	Identification (exclusion) of individual voices

Applied research projects using chemical or chemical-physical methods:

<u>Method</u>	<u>Use</u>
Laser stimulated emission spectrography	Analysis of paint flakes, metal chips, alloys in general, soil samples (following fractionation), ball-point pen, ink, possibly glass
Pyrolysis gas chromatography	Analysis of textile fibres, plastics, paint particles, oil products, etc.
Gas chromatography – mass spectrometry (GC/MS)	Analysis of narcotics, oils, synthetic textile fibres, etc.
Gas chromatography –infra-red spectrophotometry (GC/IR)	Analysis of organic solvents, oils, narcotics
Microspectrophotometry	Examination of textile fibres, hair, coloured glass and plastics, blood stains etc.
Microspectrofluorometry	Analysis of narcotics, dyes, stains of various kinds, etc.
Automated chemical analyses	Narcotics

Although the main interests of the group lie in the sphere of physics, it should eventually include (as mentioned above) some biological expertise so that pertinent problems in forensic biology can also be dealt with. In this area the following research projects may be undertaken:

1. Increase in the number of analysable blood group systems, haptoglobulins, isoenzymes and immunological (antigenic) factors for the determination of blood stains, sperm, saliva and sweat.
2. Examination of human hair by means of activation analysis, and with respect to blood group substances, cuticular patterns, mechanical characteristics, etc.
3. Biochemical methods for the development of fingerprints.

4. Application of bacteriological diagnostic methods to forensic problems.

Electronic computer processing is of growing importance in the field of criminalistics and its development would seem to be a matter of urgency, particularly as regards:

1. Continuous compilation of pertinent literature.
2. Setting up of reference files (spectra of various kinds, typewrite type, fingerprints, weapons, ammunition, pharmaceutical dosage forms, narcotics, etc.).
3. Up-dating a registry of specialists.
4. Carrying out statistical investigations in criminalistic routine work.

It seems therefore desirable that the group includes someone with the necessary qualifications for carrying out assignments in the field of electronic computer processing.

The committee has merely wished to indicate possible fields of activity for the group without going so far as to make any recommendations for the study of particular projects as these would depend on the professional qualifications and interests of its leader. It should fall to the committee for forensic science and technology (proposed below in another connection) to decide, in cooperation with the director of The National Laboratory of Forensic Science (SKL) and the group leader on suitable lines of work and projects for the group to carry out.

The committee, however, wishes to emphasise that the work to begin with should have the nature of a pilot project. Experience gained from this should provide guidelines for the group's long-term programme.

## 5.1.1.4 Research group's personnel and costs

The composition and size of the research group has been considered by the committee according to three alternatives.

Alternative A	Alternative B	Alternative C
<u>Salaries</u>	<u>Salaries</u>	<u>Salaries</u>
1 assoc.prof. (U 22:25)	1 asst.prof. (docent) (U 21)	1 asst.prof. (docent) (U 21)
5 research asst. (U 16)	4 research asst. (U 16)	1 reseach asst. (U 16)
1 research asst. (max. U 14)	1 research asst. (max. U 14)	$\frac{1}{2}$ research asst. (max. U 14)
3 lab.asst. (A 13)	2 lab.asst. (A 13)	2 lab.asst. (A 13)
2 lab.asst. (A 11)	-	-
Skr 600 000	Skr 430 000	Skr 240 000
<u>Supplies</u>	<u>Supplies</u>	<u>Supplies</u>
Skr 100 000	Skr 65 000	Skr 40 000
<u>Travel</u>	<u>Travel</u>	<u>Travel</u>
Skr 50 000	Skr 35 000	Skr 20 000
<u>Total</u>	<u>Total</u>	<u>Total</u>
Skr 750 000	Skr 530 000	Skr 290 000

1 US \$  $\approx$  4,8 Skr.

The salaries are computed according to 1972 rates, including salary supplements. The numbers in brackets denote state salary gradations.

The three alternatives given above differ considerably in resources available and thereby also in research potential. They also make different demands on the basic resources of The National Laboratory of Forensic Science (SKL). Further details on this situation are given below. The differences in research potential, however, are mainly dependent upon the size of the staff and the scope of work which this particular staff can carry out. The relationship between resources and performance in any given research group depends indeed on too many unknown factors for a more precise evaluation to be possible.

The carrying out of high-quality research projects is a long-time assignment. The type of project must not be determined entirely by current Swedish requirements, and the research work must not be hampered by demands for immediate practical results. For all three alternatives it may be said that the results and the significance of the research groups' work should be judged over a period of not less than two or three years. Both quantity and quality of scientific results depend as a rule on the resources available, larger resources producing quicker and better results. The various alternatives presented above will naturally lead to differences in results within the allotted time period.

Alternative A

This alternative permits relatively intensive activity, with an instigation of three to five research projects, as well as long-term planning of additional projects. Apart from the leader of the group, three more physicists, a chemist, a biologist and a documentalist could be included in the group. Two or three projects in the area of physics, as well as one in biology and one in chemistry could probably be initiated. It is important that the documentalist be attached to the group as early as possible in order to handle the complicated and comprehensive search of the pertinent literature. The group would require a large amount of instruments and equipment which cannot be supplied out of The National Laboratory of Forensic Science's (SKL) currently hard-pressed resources, and would therefore largely be dependent on its own equipment.

After the first year's work the group should be able to report on or publish preliminary results.

Alternative B

This alternative would permit three research projects and a reduced long-term planning as compared to alt. A.

Two projects in the area of physics and one in either biology or chemistry could probably be initiated. It would still be necessary to have the services of an energetic information specialist. Moreover, three research assistants with training in physics and one with training in biology or chemistry could be employed.

In this alternative the group must also rely on having some instruments and equipment of its own.

Alternative C

This alternative provides relatively limited resources for the research area in question. In addition a simple vacancy within a small group can threaten the entire project.

This disadvantage is aggravated when such a small group is placed in an environment essentially different from the scientific environment of a

university. However, the group can constitute a nucleus or a pilot set-up which can later be developed into a smoothly functioning unit.

It should be possible to have the first project in full swing at the end of the first year's activities.

It would, of course, be desirable to give the group sufficient resources from the start, which would be an argument in favour of alternatives A or B. The financial position of the research councils, however, makes it difficult at the moment to act on either of these alternatives. The committee, therefore, has selected alternative C for a start, on the assumption that the group will be expanded.

As regards this alternative (C), the committee has this to add: The group would be led by an assistant professor (docent) of physics with a status corresponding to that of a council researcher (särskild forskartjänst, U 21 + supplement). The committee considers it important that the post should rank above the ordinary assistant professor level (U 20) in order to make it competitive. It should be possible eventually to raise the position to an associate professorship. The scientific staff should also include a research assistant, preferably a physicist, with Ph.D. degree (U 16), as well as a half-time assistant, preferably a documentalist (maximum U 14). The technical auxiliary staff has been limited to two persons. The amount allocated for temporary personnel (included in the item of material) is intended to be used as a financial contribution to students working on particular projects in forensic science and related fields.

The amounts allocated for supplies and travel are calculated on the basis of experience. To a certain extent The National Laboratory of Forensic Science's (SKL) equipment could probably be used by the research group. As regards instrumentation and equipment, cooperation with other institutes might well be expected.

The post of group leader should be filled after due announcement of the vacancy and consultation of expert opinions, following the pertinent regulations governing appointments to special research posts.

The total sum of Skr. 290 000, should be regarded as the basic grant for the group's research work. For special projects the group leader, in consultation with the director of The National Laboratory of Forensic Science (SKL) and on the basis of experience gained from the work, may be expected to seek funds through the usual channels from research councils and other aid-granting bodies.

#### 5.1.1.5 Premises

The research group's requirements as regards premises will depend on the size of the group and the special projects which it undertakes. In view of the proposed basic staff requirements, two or three rooms as well as laboratory space will probably be needed.

The National Police Board (RPS) is willing to provide premises at The National Laboratory of Forensic Science (SKL) at the group's disposal.

The initial location of the research work at The National Laboratory of Forensic Science (SKL) does not necessarily bind this research group to any decision regarding more permanent future premises. Thus it should not be assumed that it will necessarily be transferred to Linköping. The matter ought to be reconsidered later after the group has been working for some time and when the prospects for its possible continued activities in Linköping can be evaluated more accurately than is possible at present.

As it is most important to promote research in forensic science and technology without delay, the question of The National Laboratory of Forensic Science's (SKL) transfer to Linköping should under no circumstances be allowed to delay the establishment of the research group.

#### 5.1.1.6 Other questions

The primary task of the research councils is to initiate research and develop new areas. In general terms it may be said that as soon as projects supported by the councils become firmly established and clearly meet a permanent demand, the councils must try to transfer them to the grants made available by the government at the universities and institutes of technology concerned. These guidelines laid down by the government (see bills 1959: 105, page 150) concerning activities supported by the council are also applicable to the proposed research group in forensic science and technology. Should this question arise at some future time, it can be dealt with jointly by the National Laboratory of Forensic Science (SKL), the National Police Board (RPS), the Swedish Board for Technical Development (STU) and the research councils via a budget proposal to the government.

In view of the fact that the research group can eventually be replaced by a special research division in the laboratory, it is desirable that the laboratory director — who, in accordance with The National Laboratory of Forensic Science (SKL) regulations, also heads the laboratory's criminalistic research — should be responsible for leadership of this expanded research programme as well.

In view of the facts presented, the committee proposes that the research group in forensic science and technology, financed by The Swedish Board for Technical Development (STU) and the research councils, should be established and that the group, to begin with, should be located at The National Laboratory of Forensic Science (SKL).

#### 5.1.2 Fellowship programme

Among possible measures for the initiation of research in forensic science and technology the committee – in addition to the question concerning the research group – has considered the following:

1. Assignment of fellows to foreign research centres
2. Invitations to leading foreign researchers
3. Establishment of special recruitment posts.

The committee considers that the measures specified under points 2 and 3 should be deferred pending the establishment of the research group proposed above, to which any visiting researchers and recruitment post holders should primarily be assigned.

It should, however, be feasible to establish a fellowship programme in accordance with point 1, rapidly and independently of the establishment of the research group.

The research councils has for a long time past followed the practice of awarding fellowships to younger research workers in order to encourage them to continue their studies at foreign research centres in fields which may soon prove to be important for research in Sweden. The Swedish Natural Science Research Council (NFR) at present has a fellowship programme in preparative chemistry and another in biophysics. Previously, solid state physics and other specialities have had similar programmes financed by several research councils as well as by The National Defence Research Institute and The Atomic Energy Company.

Experience indicates that by the use of this method it is possible to acquire much new knowledge for the country at relatively small cost in time and money. The specially trained fellows become valuable additions to the established research groups, or they can form the nucleus in new groups of a similar type.

The committee considers that developments in the field of forensic science and technology will be greatly stimulated by the allocation of fellowships of the type mentioned.

Considering the financial position of the research councils, the committee proposes to set up for the fiscal year 1971/1972 only one fellowship,

amounting to about Skr 50.000 <sup>1)</sup> (\$ 10.000). This sum is intended to cover travelling expenses and allowances under the same conditions which applied to the council's previous comparable fellowship programmes.

The vacancy for the fellowship should be announced in the ordinary manner in the universities and other organisations which might be interested.

For the fiscal year 1972/1973 the committee expects that a further fellowship will be added to the programme. The total expenditure for the year will thus amount to Skr. 100 000.

It is important that this fellowship programme be followed up and that the fellow on his return should be given employment in which his new knowledge is utilised. It should be possible to do this in connection with the proposed research group, or in some other way.

In view of what has been said, the committee proposes that The Swedish Board for Technical Development (STU) and the councils, grant funds for fellowship programmes in forensic science and technology.

#### 5.1.3 Scandinavian and international cooperation

The National Laboratory of Forensic Science (SKL) and the proposed research group are expected to become the principal Swedish contact units for cooperation in the scientific sphere. It should, however, depend on the researchers themselves, as is usual in other areas of research, to establish such contacts. If this is to be done in a more organised way the researchers themselves should take the initiative and propose to the relevant authorities the measures they wish to see implemented.

As regards cooperation in general and on the Scandinavian level – research policy, questions of specialisation, publications, etc. – the Joint Committee of Science Research Councils in Scandinavia fits naturally into the picture, as well as Nordforsk (the Scandinavian Council for Applied Research) and collaborating organisations in the fields of medicine and social science. The cooperation, to begin with, would be confined to an exchange of information. Should further expansion occur in forensic science and technology in the other Scandinavian countries, it may, however, become advisable to coordinate certain activities, to consider the establishment of a common Scandinavian institute, and so on. When things have reached this stage it will probably become necessary to establish a special body for promoting contacts within the area in question.

<sup>1)</sup> Since The Swedish Board for Technical Development (STU) and The Swedish Natural Science Research Council (NFR) subsequently granted this financial support, the programme can begin in the spring of 1972.

When the proposed Swedish research group has been established and a number of specialists are available in the field of criminalistics, a Scandinavian conference on the subject should be held. The purpose of this conference should be to spread in wider circles some knowledge of the subject and its current problems and to exchange information of various kinds — e.g., on organisation, grants and other matters. At a conference of this kind it might also be appropriate to discuss the question of a Scandinavian periodical dealing with forensic science and technology. Leading scientists in the field from U.S.A., France, Great Britain and other countries should be invited to participate actively in this conference.

The Committee suggests that The National Laboratory of Forensic Science (SKL) eventually should arrange conferences in cooperation with The Swedish Board for Technical Development (STU) and the research councils. The funds for this might be obtainable from the Nordic Cultural Commission and other sources.

#### 5.1.4 Establishment of a committee for forensic science and technology

##### 5.1.4.1 General considerations

The field of forensic science and technology is an extensive one which borders on many other areas and involves various scientific institutions. Cooperation between The Swedish Board for Technical Development (STU), The Swedish Natural Science Research Council (NFR), The Swedish Medical Research Council (MFR), The Swedish Atomic Research Council (AFR) and The Swedish Council for Social Science Research (SFR) for the purposes of initiating research and allocating grants, is therefore deemed desirable. As far as the application of the research results is concerned, the principle organisation involved is The National Police Board (RPS). Against this background the need for a common organisation, through which The Swedish Board for Technical Development (STU), the research council's and The National Police Board (RPS) could coordinate the research work in this field, has been considered by the committee.

##### 5.1.4.2 Foreign coordinating bodies

In section 4 the committee noted that special bodies for the coordination of research in the area under consideration exist in the USA, Canada, England and Poland. These bodies have only an advisory function in some countries (England), but in others (USA, Canada, Poland) they may grant funds. In this connection, it may again be mentioned that the principal organisation in the USA. The National Institute of Law Enforcement and Criminal Justice, which may be regarded as a research council, had a budget of \$ 7.5 million for 1970.

##### 5.1.4.3 Proposals

It is the committee's view that it would greatly further the development of forensic science and technology in Sweden if the research could be channelled and coordinated through a special organisation. By this the committee means not merely the granting of funds for various scientific and technical projects of a forensic nature, but also the initiatives that must continually be taken to lift, both the quality and the extent of the research work, to a level comparable to those of well established fields of research. For this purpose, the committee proposes the establishment of a permanent joint committee for forensic science and technology. The committee should consist of representatives from the National Police Board (RPS), the research councils and the Swedish Board for Technical Development (STU).

##### 5.1.4.4 Functions of the proposed committee

The function of the proposed committee in general would be to follow up and promote development in the area concerned and to propose to the sponsors, measures which are deemed necessary but are beyond the powers of the committee itself. Among the committee's special functions would be:

1. To act as superior authority for the research group at the National Laboratory of Forensic Science (SKL)
2. To handle the fellowship programme
3. To make grants for research purposes
4. To perform functions of a coordinating, referral and investigatory nature.

The establishment of a research group at The National Laboratory of Forensic Science (SKL) has been proposed above (5.1.1). Even though the group on the local level would come under the direction of the head of The National Laboratory of Forensic Science (SKL) and the routine work would be organised by the group leader it would be desirable, in view of the fact that the work is supported by many organisations, to coordinate the contacts between all of these. The simplest way to do this is to make the proposed committee the principal authority for the research group. The committee's function, in this connection, would, inter alia, be to follow the development of the group, propose a budget for its work and report on and evaluate the results. A special task for the proposed committee would be to study the possible effects on the group's work of The National Laboratory of Forensic Science's (SKL) impending transfer to Linköping.

Vis à vis its sponsors the functions of the proposed committee would be to seek and to receive grants of funds on behalf of the research group. On the basis of the grants received the proposed committee would specify and determine the final budget for the research group for each year's work. The powers of the committee in this respect, as well as its other duties, should be laid down in regulations issued by the principal sponsors concerned.

The fellowship programme proposed above (5.1.2) would be on a small scale to start with. To achieve the desired results the programme would have to be expanded and coordinated with the activities, inter alia, of the research group. Apart from the question of the general objectives of the programme, a number of practical measures such as the announcement of vacancies, evaluation of applications and estimation of financial requirements have to be taken in the administration of the programme. The fellowship work, moreover, must be followed up with the aim of making proper use of the fellows' newly-acquired training. This may demand the creation of assistant or research positions within the research group or in university departments. Here, cooperation will be necessary between the Swedish Board for Technical Development (STU), the research councils, the National Police Board (RPS), the universities concerned, the Office of the Chancellor of the Swedish Universities (UKÄ), the Planning Committee for Building and Equipment of Swedish Universities (LUP) and others. The committee considers it appropriate, that the functions here referred to, be concentrated in the proposed committee.

Apart from the financial requirements of the research group, funds will also be required for research projects in the proposed committee's field of activity. Such projects will probably also be carried out by institutes other than The National Laboratory of Forensic Science (SKL). These may be institutes for basic research or for applied research and development. In certain cases it will depend on the researcher's own initiative and eye for possible criminalistic applications whether such projects are realized; in other cases it will depend on the proposed committee's initiative. It is important that the proposed committee should be able to act quickly in such cases and give financial support to valuable ideas and projects. Fund granting activities of the proposed committee should be aimed primarily at promoting research and development in forensic science and technology. Over a longer period this work should be expanded to include support for research in the use of criminalistics in court procedures and prosecutor work and in preventive criminalistics. The proposed committee should also be in a position to give financial support to participation by researchers in symposia and conferences in the field in question and to organise and finance arrangements for these in Sweden. The fund requirements for such purposes are hard to calculate. In some cases the costs would be slight. This work should be developed on an experimental basis and for the first year a total amount of Skr 50.000 should be sufficient.

As regards the proposed committee's functions as a coordinating body and a referral and investigative agency, the following may be said. Below (5.2) certain measures are mentioned, that may be taken but which lie outside the powers of the sponsors of the proposed committee. One such measure of importance would be to attach the National Laboratory of Forensic Science's (SKL) professorship to a university in order to further institutionalise the contacts between the laboratory and the university world. On this point the enquiry must mark time while awaiting the possible consequences of the laboratory's transfer to Linköping. It should be the committee's function to follow up this matter and report in the course of the enquiry to the sponsors.

The proposed committee should also function as a contact agency with the Office of the Chancellor of the Swedish Universities (UKÄ) as regards teaching and examination questions and other matters in this field.

#### 5.1.4.5 Composition of the proposed committee

Forensic science and technology constitute such a wide and multifarious field that it is not feasible to represent on the proposed committee all the expertise that would be desirable. Only the main areas of the committee's activities can thus be represented. The means must therefore be found to call in the necessary specialists to meetings and committee work groups so that expert knowledge is available.

For practical reasons the number of members should be small. Experience of committee work would indicate a maximum of 11, including the chairman. The proposed committee's connections with the institutions and organisations concerned can thus be made more extensive than those of the present committee's. This is particularly important in connection with the enquiry work which the proposed committee is to perform.

The director of The National Laboratory of Forensic Science (SKL) should automatically be a member.

The other members should be appointed by the sponsors as follows:

The Swedish Board for Technical Development (STU), appoints two members  
 The Swedish Natural Science Research Council (NFR), appoints one member  
 The Swedish Medical Research Council (MFR), appoints two members  
 The Swedish Atomic Research Council (AFR), appoints one member  
 The Swedish Council for Social Science Research (SFR), appoints one member  
 The National Police Board (RPS) appoints one member

The proposed committee itself then appoints if necessary the remaining members (max 3) with a view to providing representation for appropriate institutions and specialities. The chairman is appointed by the committee

itself. The period of office for these members should be three years, with possibilities of extension for a maximum of three years.

#### 5.1.4.6 Administration of the proposed committee

The proposed committee should have the services of a small-scale secretariat consisting of the secretary and some assistant aid. Expenditure for the secretariat is calculated at about Skr. 20 000 per year for salaries, supplies, travel, daily supplement for meetings, and so on. This relatively low expenditure, however, is based on the assumption that the secretariat can be accommodated with one of the proposed committee's sponsors and thus have access to basic resources of various kinds, and that expenditure for larger and more expensive enquiries can be met outside this framework. The present committee proposes that the secretariat be attached to The Swedish Board for Technical Development (STU) or The Swedish Natural Science Research Council (NFR).

The board, when requesting funds from its sponsors, shall also propose a budget for the secretariat for the work in question.

To summarise, it is proposed above that the Swedish Board for Technical Development (STU), the research councils and the National Police Board (RPS) establish a committee for forensic science and technology.

#### 5.2 MEASURES TO BE TAKEN OUTSIDE THE FRAMEWORK OF THE SWEDISH BOARD FOR TECHNICAL DEVELOPMENT, THE NATIONAL POLICE BOARD AND THE RESEARCH COUNCILS

The measures that may be taken in this connection include:

Attachment of the The National Laboratory of Forensic Science's (SKL) professorship to a university (5.2.1)

Teaching and examinations in forensic science and technology (5.2.2).

##### 5.2.1 Attachment of the National Laboratory of Forensic Science's (SKL) professorship to a university

A question of the highest importance for the development of criminalistics is the recruitment of graduate staff to The National Laboratory of Forensic Science (SKL) primarily, and at a future date possibly also to the technical divisions of the police system. The establishment of a research group and fellowship programme which is proposed above (5.1.1 and 5.1.2) also aim at increasing the contacts between The National Laboratory of Forensic Science (SKL) and university students. The instruction provided by the director of

The National Laboratory of Forensic Science (SKL) at Stockholm University is likewise intended to further this objective. These measures, however, are insufficient.

In this connection it may be recalled that the head of the Laboratoire d'Identité Judiciaire in Paris is concurrently professor of legal medicine at the Sorbonne, and that the director of Het Gerechdelijk Laboratorium at The Hague concurrently is professor of forensic science at the University of Leyden.

It is considered by the present committee that the following developments would be desirable over a longer period (the order in which they are given indicates no chronological priority):

1. The research group at the National Laboratory of Forensic Science (SKL) should be established. Research should also be done outside the group directly lead by the director of the Laboratory. These two functions should develop into a future research division at the Laboratory.
2. The professorship at The National Laboratory of Forensic Science (SKL) should be connected with an appropriate university faculty. The professorship, however, from the organisational viewpoint belongs to The National Laboratory of Forensic Science (SKL) and the National Police Board (RPS).
3. The National Laboratory of Forensic Science (SKL) should consist of a research division and an investigation division. The Swedish Board for Technical Development (STU) and the research councils should be relieved of certain basic expenditures for the activities of the research group which would then be transferred to the Laboratory's account. The Swedish Board for Technical Development (STU) and the research councils can concentrate their efforts on supporting specific projects at The National Laboratory of Forensic Science (SKL) - i.e., follow the same pattern applicable for funds granted to researchers at universities, industrial laboratories, etc.
4. The research division at The National Laboratory of Forensic Science (SKL) would become the university department for forensic science or criminalistics. The department and the professorship, however, from the organisational viewpoint would belong to the Laboratory and the National Police Board (RPS).
5. Forensic science would become a teaching and examination subject.

The transfer of The National Laboratory of Forensic Science (SKL) to Linköping has complicated the picture as regards these measures.

If the National Laboratory of Forensic Science (SKL) had been located permanently in Stockholm, the Laboratory's professorship would have been attached to Stockholm University or the Royal Institute of Technology. Although it might seem natural that the professorship, in the event of transfer to Linköping, should be attached to the university there, it appears also desirable that the relationship with the stimulating scientific environment in Stockholm should be further developed. The organisational framework for this should be considered. A relevant enquiry would involve a number of authorities and other bodies.

The committee considers that the enquiry into the National Laboratory of Forensic Science (SKL) professorship's attachment to some university should be deferred until the situation has clarified as regards the prospects for the Laboratory's scientific activities in connection with its transfer to Linköping. It should, however, fall to the proposed committee to follow up this question.

#### 5.2.2 Teaching and examinations

Instruction in forensic science and technology must be firmly anchored in the basic sciences or in the technical subjects. Within the framework for the fil.kand. (approx. M.A.) and with emphasis on at least one of the subjects of physics, chemistry or biology, it should be possible in most cases to provide a satisfactory basis for forensic research. This would probably also be true for the corresponding studies at the institutes of technology. Research in this field will thus be included in studies for obtaining a Ph.D. degree.

Research of this kind would be carried out wherever the conditions are best. There is no general requirement that the research shall be performed at the same department where the courses are given: on the contrary, the Office of the Chancellor of the Swedish Universities (UKÄ) in its directive for the programme of studies assumes that the research work can be done at institutions outside the academic sphere. The working group for research training appointed by the office of the chancellor is not averse to the idea that persons engaged in research and development in industry, industrial research institutes, public authorities, etc., may act as supervisors in technical research training. The committee considers that this should also be possible in forensic science research training. It may be mentioned here that England has introduced a system along these lines (4.3.4).

The rules for training of research workers allow a high degree of flexibility in the choice of subjects and approach for the individual researcher. It is the function of the examiner in the subject to approve courses, examinations and theses for the Ph.D. degree. The committee considers that, in principle, there is no objection — if the examiner concurs — in giving an individual research student a slant (more or less) toward the

forensic aspects or applications of the subject studied. Such a broad view of the subject would indeed be advantageous as it would create valuable new interdisciplinary contacts while giving greater purpose and direction to the training of researchers.

It should be pointed out, that in a limited extent, research training has already started in forensic chemistry (3.4).

From a more long-term viewpoint, it would also be desirable to arrange a study programme for the fil.kand. examination (approx. M.A.), consisting possibly of two years of basic scientific studies, followed by one year of studies in forensic science and technology.

The committee considers that it should be the task of the proposed committee (5.1.4) to follow up developments in the field of teaching and, in cooperation with the Office of the Chancellor of the Swedish Universities, propose measures in support of this.

## 6. THE ALLOCATION OF COSTS

The measures proposed by the committee for the fiscal year 1972/73 are as follows:

research group	290.000	Skr
fellowship programme	100.000	
Committee for forensic science and technology:		
grants for research	50.000	
secretariat	<u>20.000</u>	
Total:	460.000	Skr

The committee estimates that expenditure for the two following fiscal years will be about the same as that given above, and will not exceed half a million crowns (US \$ 100 000), at 1972 salary rates.

The developments proposed will mainly concern the applied aspects. In view of this, the committee considers that The Swedish Board for Technical Development (STU) should meet most of the expenditure – say, 60 %. The research council's contribution would account for the remaining 40 % which, it is proposed, should be divided as follows:

The Swedish Natural Science Research Council (NFR)	20 %
The Swedish Medical Research Council (MFR)	10 %
The Swedish Council for Social Science Research (SFR)	5 %
The Swedish Atomic Research Council (AFR)	5 %

The National Police Board's (RPS) contribution would consist of providing premises and their furnishings which it would make available, as well as equipment which the group could utilize at The National Laboratory of Forensic Science (SKL).

## 7. SUMMARY

The research council's committee for forensic science and technology has had the following functions:

- to examine the possibilities of establishing a research group primarily in connection with the National Laboratory of Forensic Science (SKL)
- to propose other measures which the committee finds desirable for promoting research in the field.

The committee notes that research in forensic science and technology at present is carried out on only a very small scale in Sweden. The need to develop research in this area is obviously a matter of public importance. The responsibility for initiating such development rests largely upon The Swedish Board for Technical Development (STU), the research councils and the National Police Board.

The committee proposes that the Swedish Board for Technical Development (STU), the Swedish Medical Research Council (MRF), the Swedish Atomic Research Council (AFR), the Swedish Natural Science Research Council (NFR), the Swedish Council for Social Science Research (SFR) and the National Police Board in cooperation should:

1. establish a research group at The National Laboratory of Forensic Science (SKL)
2. establish a fellowship programme
3. establish a committee with the general function to follow the development in the field of forensic science and technology. The committee's special functions would i.a. be:
  - to act as principal authority (sponsor) for the research group
  - to administer the fellowship programme
  - to grant funds for minor projects and for travel expenses of researchers
  - to act otherwise as a coordinating body and an investigatory and contact agency.

The committee has also discussed other measures that should be taken to promote research and recruitment to this field. Among these are the attachment of the National Laboratory of Forensic Science (SKL) professorship to a university, the establishment of a programme of study in the subject and of a course for the degree of Ph.D. in forensic science.

The committee also wants to point out the need for research in forensic social science (criminalistic evidence evaluation).

The committee proposes in this connection: that a new permanent committee for forensic science and technology shall, in particular, be assigned to follow developments as mentioned above, and on this basis propose appropriate measures.

The expenditure for the first year is estimated by the committee as follows:

research group	290.000 Skr
fellowship programme	100.000 <sup>1)</sup>
Committee for forensic science and technology:	
grants for research	50.000
secretariat	20.000
Total:	460.000 Skr

It is estimated that expenditure for the proposed three-year period, will not exceed half a million Skr. (US \$ 100 000) per fiscal.

The committee proposes that the expenditure be divided as follows between The Swedish Board for Technical Development (STU) and the research councils:

The Swedish Board for Technical Development (STU)	60 %
The Swedish Natural Science Research Council (NFR)	20 %
The Swedish Medical Research Council (MFR)	10 %
The Swedish Council for Social Science Research (SFR)	5 %
The Swedish Atomic Research Council (AFR)	5 %

The National Police Board's (RPS) contribution would consist of making available and furnishing the premises necessary for the group's activities.

The committee proposes that the above measures should come into operation as of 1.7.1972.

The committee intends to apply for grants from the Swedish Board for Technical Development and the research councils concerned for the purpose of carrying out the proposed research developments in forensic science and technology.

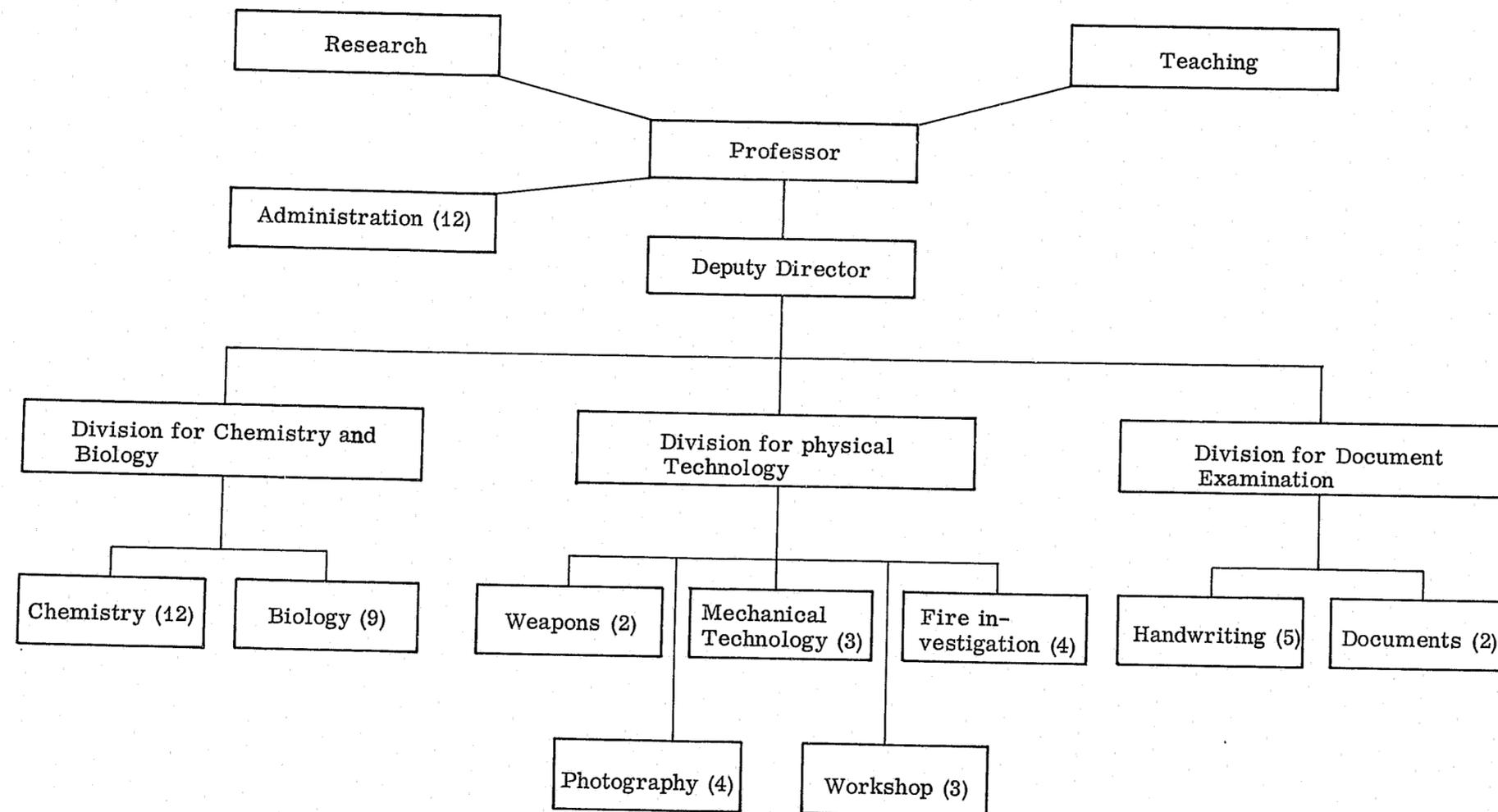
The committee therewith considers that it has completed its task, but it is prepared to remain in office during a transitional period in order to help with the preparatory work for the suggested development programme until the proposed committee for forensic science and technology has been established.

1) As the result of grants from The Swedish Board for Technical Development (STU) and The Swedish Natural Science Research Council (NFR) totalling Skr. 50 000, it has been possible to begin this work during the current fiscal year.

Abbreviations and corresponding institutions mentioned in the text

AFR	Statens råd för atomforskning Swedish Atomic Research Council
CFSO	The Center of Forensic Science, Ontario, Canada
CRE	Home Office Central Research Establishment, England
FBI	Federal Bureau of Investigation, USA
FSC	Forensic Science Committee, England
GL	Het Gerechdelijk Laboratorium, The Netherlands
HOSAC	Home Office Scientific Advisory Council, England
LEAA	Law Enforcement Assistance Administration, USA
MFR	Statens medicinska forskningsråd Swedish Medical Research Council
MPFSL	Metropolitan Police Forensic Science Laboratory, England
NFR	Statens naturvetenskapliga forskningsråd Swedish Natural Science Research Council
PEC	Police Equipment Committee, England
RPS	Rikspolisstyrelsen National Police Board
SFR	Statens råd för samhällsforskning Swedish Council for Social Science Research
SKA	Statens kriminaltekniska anstalt National Criminalistic Institute
SKL	Statens kriminaltekniska laboratorium National Laboratory of Forensic Science
SRL	Statens rättskemiska laboratorium National Laboratory for Forensic Chemistry
STU	Styrelsen för teknisk utveckling Swedish Board for Technical Development
UKÄ	Universitetskanslersämbetet Office of the Chancellor of the Swedish Universities

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Appendix 2

The number of employees appears in brackets.

List of instruments and apparatus at the National Laboratory of Forensic Science

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The laboratory can be regarded as well equipped, especially with regard to microscopes of various types. Among the major instruments, the following can be listed:

- (1) Grating emission spectrograph with electronics (RSV, SPN 3, 5/500)
- (1) Prism emission spectrograph (Zeiss Qu 24)
- (1) Spectrum dual projector with densitometer, computer and printer (Steinheil)
- (1) Recording grating UV-spectrophotometer (Bausch & Lomb)
- (1) Prism UV-spectrophotometer (Zeiss M4Q)
- (2) IR-spectrophotometers (Perkin-Elmer 221 and 251)
- (1) Atomic absorption spectrophotometer (Perkin-Elmer 503)
- (3) Gas chromatographs (Perkin-Elmer, two F 11 and one 800)
- (1) Automatic melting point apparatus (Mettler FP 51)
- (5) Comparison microscopes (3 Leitz and 2 Projectina)
- (1) X-ray equipment (60 kV)
- (1) Infrared viewing apparatus (Wild)
- (1) Grating monochromator (Bausch & Lomb)
- (1) Short interval timer for the measurement of the speed of projectiles
- (1) Electrophoresis unit
- (2) Microtomes
- (12) Stereo microscopes
- (25) Microscopes of various designs
- (6) Photographic cameras with accessories (one of each):  
Traut-Simplex, Sinar, Hasselblad 1000 F, Nikon, Szabad (macro),  
Zeiss Tessovar (semi-micro)

(4) Enlarging apparatus (3 Durst, 1 Agfa)

(1) Colorfilm developing apparatus (Kodak)

The equipment further includes:

About 10 balances of various kinds, refractometers, polarimeter, pH-meter, flame point apparatus, micro melting point apparatus, centrifuges, ultra-violet lamps, electrical measuring instruments, refrigerators and freezers, photostat equipment, mimeograph equipment, tape recorders, workshop machines, etc.

The number of apparatus in brackets.

**END**