Fact sheet – Guidelines for interpretation of DNA comparisons in Match Reports and Written Statements

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DNA investigation

The Swedish National Laboratory of Forensic Science (SKL) analyses biological stains and are then able to receive complete or partial DNA profiles. These can be compared to the DNA profiles from assigned persons or from DNA databases.

Comparison of stains and assigned persons

In cases where there is an assigned person (suspects, victims, others), the DNA profile of this person is compared to DNA profiles of stains.

The analyse result and the evaluation of the comparison is presented in a *Written statement* with a graded scale of conclusions.

In cases where there are stains but no assigned persons the obtained DNA results are presented in a simplified case report.

Comparison of stains against DNA databases

If the DNA profile form the stain differs from the assigned person or if there is no suspect in the case, the DNA profile can be placed in and compared to the DNA database containing stains, suspects and convicted offenders. At this kind of search there might be matches against stains and persons already in the DNA database, i.e. you get matching DNA profiles.

The handling of matches is strongly automated and the evaluation of the comparison (the match) is presented immediately, as a *Match report* with a graded scale of conclusion.

Comparison of a known person against DNA databases

In cases where the person has been sampled for DNA, the evaluation of the comparison (the match) is presented in a *Match report* containing a graded scale of conclusion.

The DNA evidence

The following is valid for the DNA evidence that occurs at a match between the DNA profile for a person and a stain:

- The DNA evidence has the same certainty if the concordance originates from a comparison with an assigned person or if the concordance was discovered in a DNA database match.

- The conclusion in a *Match report* and the corresponding conclusion in a *Written statement* are equally established in the DNA result; even in cases with DNA database matches between a stain and a person we expect the same result also the next time, if the direct comparison of a newly taken DNA sample from the person is repeated. If an error is suspected, a new DNA sample should be taken from the person or the analyse of the stain should be repeated.

With the help of a graded scale of conclusion SKL can assign at what strength the DNA evidence

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should affect the assignors view of the connection between a person and a stain before the DNA evidence is used (connection means if a person is the source of the stain or not).

The person is strongly suspected in a case. A connection consisting of known circumstances against the suspected is known before the DNA evidence is considered. The DNA evidence will reinforce the view of the connection with a known factor.

The person in the case is a completely unknown person. When the DNA evidence is known, the same DNA evidence will reinforce this weak link with the same known factor.

From SKL:s point of view the effect of the DNA evidence has the same strength in both cases.

For the commissioner the end result, i.e. the evidence value, is stronger in the first case. In the first case the DNA evidence is added to a view that is based on the circumstances that are known before the DNA evidence occurred. In the same way the evidence value will be weaker in the latter case, as the DNA evidence is added to the opinion that is based of the non-existent knowledge about this person before the DNA evidence (the match) occurred.

In the latter case support evidence of other kind should be obtained in the preliminary investigation that has started after the knowledge of the DNA evidence.

Interpretation of Match reports and Written statements
Unknown person

In a *Match report* concerning a person a match is shown for concordant results, a match, concerning an individual who is often (but not always) *unknown* in the case. Before the DNA evidence is known this person is one of many persons whom could all have left the stain. The DNA evidence that occurs after this will result in a reduction of this number of persons. The grade of reduction depends on how complete and how unusual the DNA profile is.

Known person

In a *Written statement* concerning a person the concordant result, a match, is shown against an assigned person who is known in the case. There is a known or a suspected connection between the person and the crime. Before the DNA evidence is known this person is one of a smaller amount of persons who all can be the person that left the stain. The number of persons has already been reduced, based on other information that has emerged in the case. The concordance also results in a further reduction of this reduced number of persons, and when there is a complete or unusual DNA profile the number is normally reduced to one person.

Probabilities

The above can be seen in terms of probability of the possibility that the person that has been identified by the match or the already suspected person has left the stain.

Presuming that there is 1 million unrelated persons who could be the source of the stain at the time

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of the identification of the match report, (before considering the DNA evidence), and the grade of the match report is +4 in the scale of conclusions, the probability is at least 50% that this person has left the stain.

On the other hand, if we presume that there are 10 unrelated persons who could be the source of the stain (before considering the DNA evidence), and the grade of the concordance is +4, when comparing the DNA profiles of the stain and the suspected person, you could state that the probability that this person has left the stain is at least 99,999%.

Please observe that these differences do not depend on the DNA results in the *Match report* or the *Written statement*, but on the number of persons who could be the source of the stain before claiming the DNA evidence. This number can not be estimated by SKL but is very important considering the conclusions that shall be drawn by the court.

The discussion above also shows that different grades in scale of conclusions in the *Match report* and *Written statement* might give similar strength in the conclusions in the court. If assuming that there are 10 000 unrelated persons who could be the source of the stain (before considering the DNA evidence in a match report) and the grade in the match report is +4, the probability is at least 99% that the identified person has left the stain.

Assuming that (in another case) there are 50 unrelated persons who could be the source of the stain (before considering the DNA evidence) when comparing the DNA profiles of the stain and the suspected person and the grade in the scale of conclusion is +3, the probability that the suspected person has left the stain is also at least 99%. However, if it is only 10 persons who could have left the stain (before considering the DNA evidence), the latter probability will increase to at least 99,9%.

A positive grade in a *Match report* or in a *Written statement* will result in a decrease of the number of persons who can be the source of the stain. Alternatively it can be expressed as the Match report/Written statement reinforces the view of the existing connection between a person and a stain before claiming the DNA evidence. The following schematic figure illustrates the process
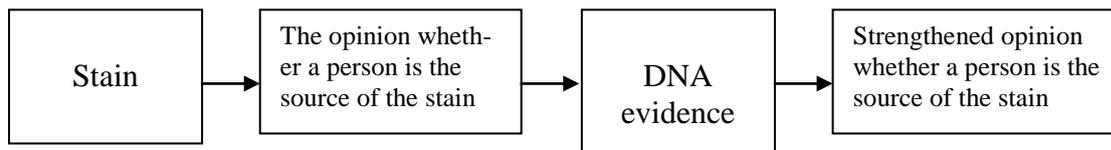
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The Diagram 1 and 2 below can be used for having an overview of the probability that an appointed person relates to the number of possible persons who could be the source of the stain (before considering the DNA evidence) for the four different grades +1, +2, +3 and +4. Diagram 2 only shows the probability interval 99-100%.
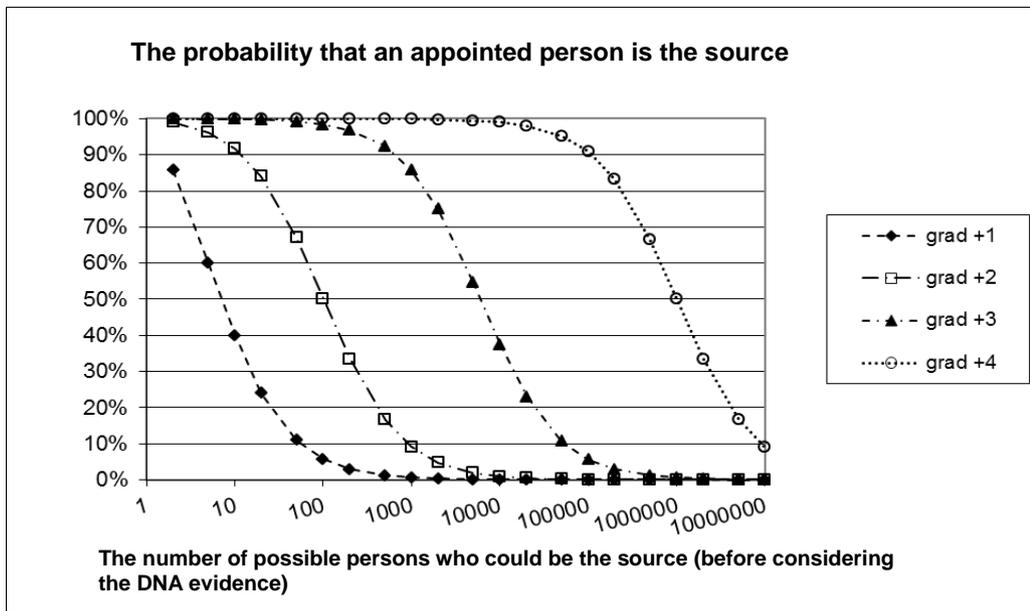

Diagram 1. The lowest probability that an appointed person is the source, as a function of the number of possible persons who could be source for the result with the grades +1, +2, +3 and +4 (the scale on the x-axis is logarithmic).
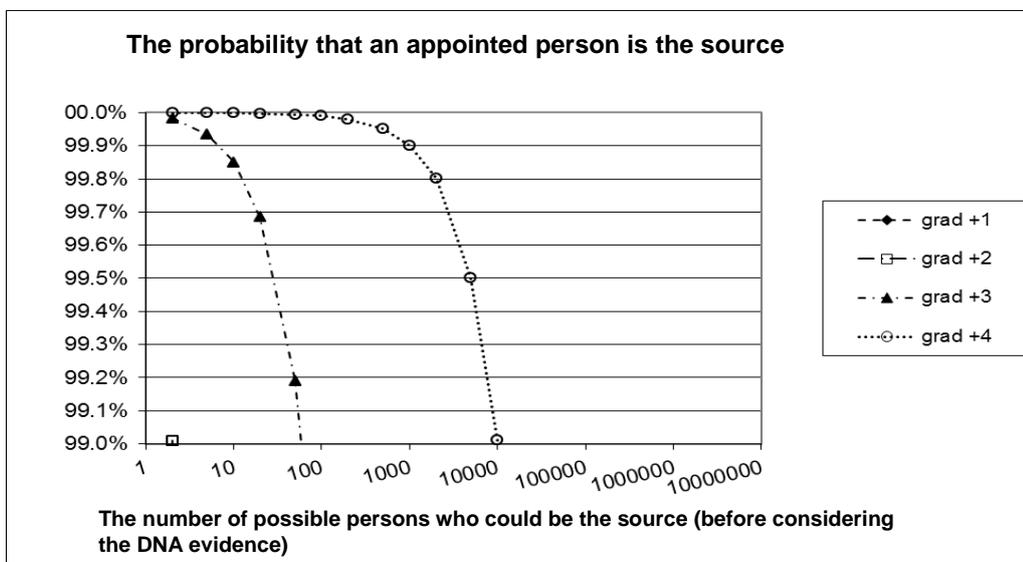

Diagram 2. The lowest probability in the interval 99–100% that an appointed person is the source as a function of the number of possible persons who can be the source for a result with the grades +1, +2, +3 and +4 (the scale on the x-axis is logarithmic).

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An example

Assuming that a rape is committed in a housing area and that a fresh sperm stain, with the suspected perpetrator as a source, has been found. The stain is sent to SKL with a request of a DNA analyse. Before obtaining a reply from SKL an assessment of the number of potential perpetrators is made, based on information from witnesses and other circumstances in the case. The estimate is that the perpetrator is between 18 and 25 years old, and that he talks with the accent that is the most frequent in the region. A geographical delimitation gives the result that approximately 6.000 men could, theoretically, be the perpetrator and thus also the source of the stain.

SKL analyses the stain and gets a match to the person X on the DNA profile in the DNA database. The DNA profile results in a grade +3 match, meaning that the result strongly supports that X is the source of the stain. A check shows that X is released from custody and domiciled in the region.

If combining the DNA result with the earlier assumption that approximately 6.000 persons theoretically could be the source of the stain, this results in a probability of at least 50% that X is the source of the stain (observe that the scale in Diagram 1 is logarithmic).

Meanwhile, the investigation of the crime proceeds and with further help from the information given by the witnesses it could be possible to reduce the group as a potential source of the stain to 10 men, and X is one of them. Studying the Diagram 2 it is possible to see that with 10 possible persons who could all be the source of the stain, and the result shows with grade +3 that X is the source, the probability is at least 99,8% that X is the source of the stain.

Information

- http://skl.skl.police.se/html/fakta/traffrapportering: Fact sheets
- https://intrapolis.polisen.se/yoa556_101_660/Arbetsrum/Arbetsrum/Samverkan/00-Nationellt/Traffrapportsamordnare-dna---Samverkan-Gemensamt/: Work room

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