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## OPEN LETTER ON CRITICAL APPROACHES TO FORENSIC DNA PHENOTYPING (FDP) AND 'BIO-GEOGRAPHICAL ANCESTRY' (BGA)

### Preface

Germany is currently re-assessing the regulations for forensic DNA analysis. At the core of the discussion is whether or not to introduce forensic DNA phenotyping (FDP), as well as biogeographical ancestry testing (bga), in the context of criminal investigations.

The debate was triggered by the rape and murder of Maria L., a medical student of our university (University of Freiburg) on October 16, 2016. Soon after she was found, speculations that the murder had been committed by "foreigners" began circulating through social media, and soon developed a strong impact on the public sphere in Freiburg. Some weeks later, initiatives and individuals on the far right began to call for the introduction of FDP and bga to identify the "race" of the murderer and to "stop protecting murderers". This request was soon picked up by police representatives and journalists in the region who claimed that FDP would allow to efficiently narrow and focus the investigation.

On December 3, 2016 a suspect was arrested due to a hair the investigators had located in material from the crime scene. Matching the DNA found on the victims body, the long black hair, which was partially dyed blond, allowed the police to re-view surveillance footage, to identify a young man with a corresponding hair-style, and to arrest him shortly after. The murder suspect turned out to be a young refugee from Afghanistan.

On the day of the arrest, police representatives reiterated their demand to allow for FDP in the future. Guido Wolf, the Minister of Justice, and Thomas Strobl, the Minister of the Interior, of Baden-Württemberg, the federal state Freiburg is located in, announced they would fully support this request and push for a quick change of the German criminal procedure code (Strafprozessordnung, or StPO).

Our [Open Letter](#) was published on December 8, 2017 as a scientifically founded response to the one-sided arguments brought forth by police representatives, politicians and journalists dominating the highly charged public debate at that point. It was conceived by an ad-hoc initiative of scholars from the Universities of Freiburg i.Br., Frankfurt/M. and Northumbria (UK).

Originally comprising scholars from Science and Technology Studies (most notably the team of Prof. Dr. Veronika Lipphardt at University College Freiburg that initiated the Open Letter), Bioethics and the Social Sciences, our group has since grown to integrate scholars from Molecular Genetics, Biometrics, Statistics and Biomedicine. While the broad spectrum of members of our initiative allows for a multi-perspective approach to the issues at hand, it does certainly not allow to cover *all* aspects necessary to take into account when assessing the

benefits, challenges, limits and disadvantages going along with FDP. Similarly, however, Forensic Scientists and Criminologists cannot claim to be able to assess *all* relevant aspects which need to be considered in respect to the proposed bill.

Guido Wolf, Baden-Württemberg's Minister of Justice, with the support of Winfried Bausback, Minister of Justice of Bayern, have since moved forward to introduce a bill to change the German criminal procedure code with the declared aim to pass and implement the paragraphs allowing for FDP within this legislative period (which ends in July, due to the up-coming German election this fall).

We have accompanied this process critically, by providing e.g. an expert statement at a hearing on FDP held at the Federal Ministry of Justice and Consumer Protection on March 21, 2017, by asking politicians and media to pay attention to this issue and the complex scientific aspects involved, by media contributions of our own, and by a more extended critique soon to be published on this website.

The proposed bill is pushed through with high speed – not allowing for the scientific, legal and political debate that would be necessary to come to an informed solution. It also neither contains any provision for regulating data-protection and ethical issues, nor for adequate training of law enforcement professionals who will be handed a highly complex investigative tool, which carries with it immense ethical, social and political challenges. Likewise, much of the public debate up until the expert hearing in Berlin was one-sided in its appraisal of the technologies' great potential, hardly ever mentioning the many open questions, limitations and ensuing risks.

We therefore demand the involvement of diverse multi-disciplinary expertise throughout the legislative process and for enough time to allow for a substantial public debate on FDP.

For the public statement of our group, relevant legal and political documents, background information, an overview over the media coverage and a resource section with reading recommendations please see our website ([www.stsfreiburg.wordpress.com](http://www.stsfreiburg.wordpress.com)).

**OPEN LETTER ON CRITICAL APPROACHES TO FORENSIC DNA PHENOTYPING (FDP) AND 'BIO-GEOGRAPHICAL ANCESTRY' (BGA), published online 08 Dec 2016**

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*This is a translated verbatim version of our Open Letter. Meanwhile, we have expanded our argumentation considerably. Any addition to the original text is marked by [square brackets]. No further changes have been made to the text. For further clarification and complementation, we have added footnotes with additional information. For readers who are not familiar with the German legal situation, or with the public debate in and beyond Freiburg, we will provide a contextualization on this website soon.*  
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“The use of DNA technologies in criminal investigations is neither simple nor trivial. Anyone calling for the extension of the kinds of technologies permitted in police investigations must first take serious note of the complexity of these technologies, including the [scientific,] legal, ethical, and social risks [and challenges] that can impact each and every individual citizen.[1]

The murder of a University of Freiburg student in mid-October has deeply moved and unsettled the city in the recent weeks. Investigations, and in particular the discovery of DNA-traces on the victim's dead body, provoked demands for a change in the law regulating forensic DNA analysis in Germany. New kinds of DNA-analysis, thus the calls from many, including high ranking politicians, should be used to help to narrow down the group of possible perpetrators by determining the suspect's ["bio-] geographical origin[“], and hair, skin, and eye color.

A significant piece of evidence was a hair which the forensic lab staff found at the crime scene.[2] The hair's natural color could have been analysed via DNA, even though this technology can be wrong in one out of ten cases.[3] But even a correct analysis would not have served the investigators, as there sure were many persons with dark hair on the video footage. What ultimately made the hair useful were its striking coloring, length, and an unusual hairstyle. Only in this combination could the video recording and hair data help produce a suspect. DNA alone could never have delivered the most helpful contextual data.

The new DNA-analyses constitute a highly complex technology. Its reliability in forensic police work is still to be assessed. Countries have made diverse experiences with these technologies.

There has been some successes, for example in the Netherlands. But there also have been disastrous examples of technical errors, misapplications, and mistaken interpretation, as in the case [of the “Operation Minstead” in the UK, or] of the „Heilbronner Phantom“ in Germany itself (see below). DNA cannot be taken as an exact, one-to-one, catalog of a person’s physical characteristics. In addition, a scientifically sound evaluation of these techniques’ applicability in the legal context is still pending, and it is notoriously hard to perform such an evaluation: currently there are neither enough resources nor sufficient frameworks in place to comprehensively assess the combined technical, societal, and ethical risks of such technologies.

At stake is nothing less than the relationship between the state and the individual. This makes the widespread lack of awareness of the constitutional implications of these technologies even more troubling. Indeed, it is not only minorities that are affected by the risk of misinterpretation and misidentifications that these technologies bear; in fact, everyone might be affected. The questions concern data security and privacy; fundamental legal principles such as the presumption of innocence; the burden of proof and the proportionality of the investigative methods and state responses; the relationships among security, justice, and the law. What are the limits for the application of DNA analysis? What DNA databases can be used by the police and other security agencies, and how? How is this data handled? Should information from different ‘commercial, medical and governmental repositories containing human material’ be combined and linked? By whom, for what purpose, in what situation, and for how long? Caution regarding this technology is not about protecting criminal offenders (as some have suggested), but about protecting the rights of each and everyone.

### **What are these technologies, and how reliable are they?**

It is a common belief that technological feasibility should dictate legal applicability.[4] Yet such uncritical faith in technology presents a serious risk for democracies and—particularly visible in the current case—for constitutional principles. Research from scholars of social science, law and the humanities in Germany and beyond have carefully scrutinized forensic DNA technologies and their inherent risks to contemporary societies.

As with the evaluation of any technology, decision-makers should call on balanced and diverse expertise.[5] In this particular case, one needs to consider three different technologies: The comparison of a DNA found at a crime spot to those in a forensic database in order to find an exact match; analysis of externally visible characteristics from crime-scene DNA to predict how the unknown suspect looks like; and the prediction of biogeographical origin (regional ancestry) using large DNA databases. All three can produce mismatches, albeit not all to the same degree. Societal preconceptions are inherent in all of these methods and play a decisive role in their application. As a result, false positives and errors tend to impact particular population groups to varying degrees.

The first technology, which is legal in Germany, compares crime-scene DNA with existing DNA profiles from unresolved criminal cases in police DNA databases. In June 2015, the German

database contained nearly 840,000 profiles of suspects, arrested persons, and detainees. Thus, it is also possible to find biological relatives of an unknown suspect who are already registered in the database, although they are by no means always criminals. This search type—known as “familial searching”—can encourage the suspicion of “criminal families”, which in turn could also adversely affect the treatment of these individuals in the judicial system. While not yet allowed in Germany[6], the police use familial DNA technology, for example, in the Netherlands as well as in England and Wales.

The second technology, which is currently not permitted in Germany, aims to determine externally visible characteristics such as hair and eye color. It is based on the analysis of genes which co-determine these very properties. Other features such as facial shape, skin color, or body size are still considered to be too complex to be predicted reliably. Although much has already been achieved in regards to determining hair and eye colors, not all variants can be predicted with the same probability; in the case of the derivation of light or dark eye color, for example, the accuracy is 90-95 percent, while the intermediate (which includes gray, green and light brown) is much lower.

The third technology, which is also currently not permitted in Germany, analyzes the “biogeographical ancestry” of a DNA sample, i.e., the genetic relationship with a predefined population group, e.g. “Northern European” or “East Asian”. The underlying basis for the determination of biogeographical descent is the assumption that the frequency of certain genomic sites can be associated with certain population groups. In concrete terms, several thousand genomes are stored in reference databases, and for each individual in these databases, the “biogeographical ancestry” is included in the data set. Based on this ancestry information, the databases are divided into several reference populations—in the USA, for example, into African Americans, European Americans, Asians, Hispanics, etc. These databases for biogeographical ancestry determination are not police databases but commercial, biomedical, or scientific databases.

The interpretive value of these databases is questionable: no single existing database can claim to represent human genetic diversity in a balanced way. Yet the reliability with which a DNA sample can be attributed to a reference population depends on whether the reference population in question is under- or over-represented in the database. In addition, each subject is assigned only to a single population; reference population names are arbitrary and non-standardized between databases; and the original assignments to these reference populations are not done using the same criteria in each database. The possibility of the exact assignment of a DNA trace to a reference population in the database is not the same for all persons: Depending on the individual ancestry and their self-attribution, the assignments can be completely wrong. Furthermore, many investigators, scientists, and other interested parties confuse “biogeographical ancestry”, “bio-ethnicity” and “ethnicity.” The fact that existing commercial, biomedical, or scientific databases need to be used for this purpose entails further risks.

## **Legal, ethical, social objections**

Any society that calls for the expansion of forensic DNA analysis must be aware that, as a result, DNA databases themselves would have to be expanded significantly, and that the data gathered must be treated with utmost caution. This is by no means self-evident. In England and Wales, the police are permitted to obtain DNA samples of anyone who is suspected or arrested. The data gained from these samples is entered into the National DNA Database of the Ministry of Interior. Certain groups of persons—young men or minorities, for example—are overrepresented as a result of the police disproportionately focusing on these groups of people. These profiles can then also be checked during familial searches.

In the US, the police have obtained access to commercial DNA databases. A year ago in Texas, blood samples from newborns were transferred to a military forensic laboratory without consent from the parents. Similar sorts of things occur elsewhere with biomedical data from clinics. In England and Wales, as well as Texas, the police benefit from generous laws concerning the use of genetic technologies. This entails threats to certain rights, which Germans would certainly not be ready to accept—if they knew about them. Those who want to change the laws for forensic DNA-analysis must do a significant amount of work to guarantee the fundamental rights of minorities, as well as of much larger populations.

Using DNA technologies to determine physical appearance and biogeographical origin have the potential to transform whole populations into suspects, regardless of the guilt or innocence of individual members of those groups. Would it then be justifiable, on account of the statistical probability that the suspect has a certain appearance or a certain geographic ancestry, to demand alibis or other proof of innocence from the members of this suspected population? While criminal prosecutions usually attempt to focus suspicion to avoid such situations, this may not be possible with these technologies.

A tremendous amount of biological, ethical, and social science expertise is required to evaluate the validity of these technologies and the suitability of the databases in a balanced way. Moreover, the investigators themselves would need significant additional competencies because DNA data cannot simply be combined intuitively with classical investigation methods.

### **An example from Baden-Württemberg: The „Heilbronner Phantom“**

Ultimately, the interpretation of DNA evidence within police investigative work always takes place at the interface between supposedly objective and exact natural science on the one hand, and socio-cultural interpretations on the other, and at the intersection of scientific knowledge and police experience. The so-called „Heilbronner Phantom“ has made the risks and sources of error involved quite clear.

After a police officer named Michèle Kiesewetter was killed in the town of Heilbronn in April 2007, a special commission established to investigate the murder found DNA traces at the

crime scene. According to the DNA database of the Federal Criminal Police Office (known as the BKA) the trace belonged to an „unknown female person“ („UwP“) whose DNA appeared to be involved in a large number of crimes in countries including France, Germany, and Austria. In Austria, where the technology is legal, the sample was analyzed for its „biogeographical origin,“ and the investigators reported that the genetic markers of the „UwP“ pointed to Eastern European origin. According to press reports and investigators, the special commission concluded that the „UwP“ was probably a „gypsy“ [sic] or „a family member of a family of travelers“ of Eastern European origin. This suspicion persisted for over two years, aided in part by a significant media bias supported by close cooperation between journalists and the police. Moreover, this idea was bolstered by the collection and storage of at least 800 DNA samples from women „who corresponded to the criminal profile of the UwP“ and have been “buccal swabbed” such that the DNA data resulting from these samples could be matched with data in the BKA database.

In March 2009, however, it became clear that the cotton swabs used at crime scenes where DNA from the “UwP” was found had in fact been contaminated during their production by a female factory worker of Polish origin. In November 2011, the investigators claimed that Michèle Kiesewetter had been murdered by NSU terrorists. For more than two years, however, these misinterpretations of DNA evidence had resulted in undue suspicion of traveling families in general, while the actual perpetrators, the NSU and its supporters, remained undisturbed. The then Minister of the Interior of Baden-Württemberg, Reinhold Gall (SPD), officially apologized in 2012 for the false suspicions to the Central Council of the Sinti and Roma, although, according to our findings, not to the affected women and their families. To date, it is unclear whether all data sets that were fed into the BKA DNA database at that time and that have spread across Europe by Interpol have been deleted entirely.

## **Conclusion**

While the technical standards in forensic DNA profiles are now very good and are constantly improving, there may still be contamination, mix-ups, and misunderstandings during the police investigation. It is, for example, very important to make a distinction between the use of DNA analysis for determining individual identity on the one hand and for deriving external features and lineage on the other: The latter is open to an immensely greater degree of discretion in the interpretation which is strongly influenced by cultural and institutional practices and attitudes. Cases of incorrect suspicion could dramatically increase if DNA analysis were suddenly expanded without engaging the social, ethical, legal, and cultural aspects directly in the law itself. Anyone who claims DNA analysis in police investigation is simple, trivial, reliable, unproblematic and unambiguous, and thereby implies that technology does not need any social, ethical, or legal limitation, is not only wrong. They are acting irresponsibly.

[1] Meanwhile, we have identified flaws in the public presentation of the scientific reliability of these technologies; many questions regarding the scientific basis of the claimed reliability are yet open. For more information, there will be an update of this website coming soon.

[2] The hair was half black, half colored blond. Investigators checked the video tapes of the nearby public transportation and found somebody with a striking hair style that fit these colors.

[3] With prevalence adjustment, the relevant posteriori probability can be much lower than 90%. For our argument on misleading presentations of probabilities in the public, there will be an update of this website coming soon.

[4] We have meanwhile elaborated a position challenging the scientific basis of the application of these technologies. This position will be published soon (you will find the references on our website).

[5] We meanhere the expertise of forensicists, investigators, life scientists, statisticians, law scholars, bioethicists, and other scholars from the humanities and social sciences.

[6] A law including familial search is currently under review by the Bundesrat.

#### **Reading suggestions** (for an extended list, see "Ressources")

[Cole SA and Lynch M \(2006\) The social and legal construction of suspects. \*Annual Review of Law and Social Science\* 2: 39-60.](#)

[Heinemann T, Lemke T and Prainsack B \(2012\) Risky profiles: societal dimensions of forensic uses of DNA profiling technologies. \*New Genetics and Society\* 31\(3\): 249-258.](#)

[Hindmarsh R and Prainsack B eds. \(2010\) \*Genetic suspects: Global governance of forensic DNA profiling and databasing\*. New York: Cambridge University Press.](#)

[Jasanoff S \(1998\) The eye of everyman witnessing DNA in the Simpson Trial. \*Social Studies of Science\* 28\(5-6\): 713-740.](#)

[Lynch M, Cole SA, McNally R and Jordan K \(2010\) \*Truth machine: The contentious history of DNA fingerprinting\*. Chicago and London: University of Chicago Press.](#)

M'charek A (2008) Silent witness, articulate collective: DNA evidence and the inference of visible traits. *Bioethics* 22(9): 519-528.

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[Santos F, Machado H and Silva S \(2013\) Forensic DNA databases in European countries: is size linked to performance?. \*Life Sciences, Society and Policy\* 9\(1\): 1-13.](#)

[Toom V \(2012\) Bodies of science and law: forensic DNA profiling, biological bodies, and biopower. \*Journal of Law and Society\* 39\(1\): 150-166.](#)

[Toom, V., Wienroth, M., M'charek, A., Prainsack, B., Williams, R., Duster, T., ... & Murphy, E. \(2016\). Approaching ethical, legal and social issues of emerging forensic DNA phenotyping \(FDP\) technologies comprehensively: Reply to 'Forensic DNA phenotyping: Predicting human appearance from crime scene material for investigative purposes' by Manfred Kayser. \*Forensic Science International: Genetics\*, 22, e1-e4.](#)

[Wienroth M, Morling N and Williams R \(2014\) Technological innovations in forensic genetics: social, legal and ethical aspects. \*Recent Advances in DNA & Gene Sequences\* 8\(2\): 98-103.](#)