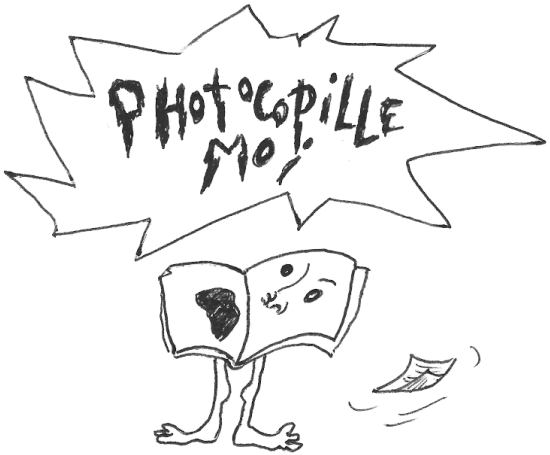
This is a practical zine, but we'll take (brief) detours through theory. First, we'll talk about how cops work with DNA. Then we'll offer ideas for how to make their job as difficult as possible, both by giving tips to develop your own security protocols and by proposing a protocol that we consider appropriate. At the end, we've added more theoretical appendices on the biology of DNA and on some technical aspects of its use by scientists.

No Trace Project / No trace, no case. A collection of tools to help anarchists and other rebels **understand** the capabilities of their enemies, **undermine** surveillance efforts, and ultimately **act** without getting caught.

Depending on your context, possession of certain documents may be criminalized or attract unwanted attention—be careful about what zines you print and where you store them.

DNA You Say?

Burn Everything to Burn Longer: A Guide to Leaving No Traces



"Photocopy me"

DNA You Say? Burn Everything to Burn Longer: A Guide to Leaving No Traces

Original text in French

blablADN. Tout cramer pour brûler + longtemps : un guide pour ne pas laisser de traces

blabladn@riseup.net

2021

Translation and layout

No Trace Project

notrace.how/resources/#dna-you-say

"Sequencing when does it stop?"

Note from the No Trace Project:

We hope that this translation will help English-speaking anarchists to better understand and protect themselves against the dangers of DNA.

We added many footnotes, either to add information or to explain our disagreements with the original text, especially in the section "A protocol for two", p. 34. Our footnotes are preceded by "*N.T.P. note*", whereas the original footnotes are not.

We did not include the original appendix which listed French forensic police laboratories and their suppliers, because we didn't think it was relevant to an international audience.

Contents

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Introduction

Why this publication?

DNA evidence is now widely used by the judicial system as a tool of repression. In this context, circulating unverified information such as "acetone destroys DNA" puts people at risk of repression. The aim of this zine is both to understand how the cops identify a person using DNA and to propose ways to protect oneself from identification.

We would like to see the disappearance of the prisons, the courts, the police stations and all those who participate in the machinery of repression. The idea here is to participate in building a security culture around genetic profiling. We will mainly talk about DNA, which is only one issue among many others when it comes to security in the face of repression.

DNA evidence is an article of scientific faith. No matter how much we believe in science, judges lock people up on this basis. We will use a scientific point of view, which is a partial point of view. In these pages, we do not propose a critical reflection on the use of scientific techniques around DNA identification, nor on science in general. And yet, there is a lot to think about.

"Fuck the justice system"

What's in there?

This is a practical zine, but we'll take (brief) detours through theory. First, we'll talk about how cops work with DNA. Then we'll offer

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Appendix C: Game of the Goose

ideas for how to make their job as difficult as possible, both by giving tips to develop your own security protocols and by proposing a protocol that we consider appropriate. At the end, we have added more theoretical appendices on the biology of DNA and on some technical aspects of its use by scientists.

There are sections that use scientific jargon. The zine contains a glossary, for all words followed by an asterisk*. In the text there are numbered references [in square brackets] which are collected in the bibliography.

What we are hoping for from this zine

What we don't want is for you to take us at our word. What we want is for this zine to be modified, reappropriated, and freely distributed. There are several things that are important to us: that the text is accessible, that there is access to scientific references and so to tools for free access to science, that there are several levels of reading so that you can pick out what interests you, and especially that you feel free to modify, print, reproduce, or share it and lots of other fun stuff.

For our references, we used some books and scientific articles, which are all in the bibliography. Some of the books can be found on Libgen (Library Genesis)[1], and some of the articles are available on SciHub[2]. These sites are accessible via the Tor Browser, although they may be occasionally down. Some scientific books are also available in university biology libraries.

> Sadly, progress doesn't stop, and all scientific repressive techniques evolve and get refined. This zine should be updated regularly, or at least taken for what it is, with all the caution in the world: a

[1] LibGen is a search engine that allows you to find and download free books and articles that are otherwise not free.

[2] SciHub is a site that provides free access to many paid scientific research articles.

zine made in 2020 using references published between 1970 and 2020.

Further reading

This text does not cover everything, and there are a lot of great texts on the subject, such as:

- *L'apparence de la certitude : l'ADN comme "preuve" scientifique et judiciaire*[3] [The appearance of certainty: DNA as scientific and legal "proof"].
- *Du sang, de la chique et du molard ! Sur l'ADN*[4] [Blood, Spit, and Snot! On DNA.].
- *"Ouvrez la bouche", dit le policier*[5] ["Open your mouth", says the policeman].

[3] https://notrace.how/resources/#lapparence-de-la-certitude
[4] https://notrace.how/resources/#du-sang-de-la-chique-et-du-mollard
[5] https://notrace.how/resources/#ouvrez-la-bouche-dit-le-policier

all the positions of the *A*'s in this sequence. We can then do the same thing with *C*, *G* and *T*!

There was a time when **sequence polymorphism*** was used for forensic DNA analysis, i.e., whether the DNA used had the *ATTACG* sequence or the *ATTACC* sequence. Now they use **length polymorphism**, by analyzing the lengths of repetitive sequences, i.e. they try to know if *ACG* for example is repeated 10 or 12 times in the sample.

Capillary electrophoresis and multiplex analysis

Today, there is also the **capillary electrophoresis** technique, which allows for much larger potential differences and therefore faster migrations. It is the same principle as gel electrophoresis, but instead of being done on a gel plate, it is done in a capillary. It is a state-of-the-art tool used by forensic police.

Limitations of multiplex analysis and partial solutions

Having several STRs poses a problem for electrophoresis: each individual has a maximum of 2 different alleles* for each STR, so if they analyze 2 STRs at the same time, they have 4 potential alleles. The challenge is to know to which STR each allele belongs to. This can be solved by taking STRs of different lengths. For example, if, for a gene*, all the alleles are between 100 and 170 bp*, and for another gene, all the alleles are between 200 and 250 bp, they can be analyzed at the same time by electrophoresis without risking confusion.

However, they cannot analyze as many STRs as they want all at once, because this implies having larger and larger STR alleles, and the effectiveness of PCR has size constraints. So there are limits to simultaneous STR analysis.

Another solution is to attach fluorescent primers on the different STRs to differentiate them at the time of electrophoresis analysis.

Multiplexed STR analysis

PCR is easy to use and can amplify several DNA fragments simultaneously (just add primer pairs). This is called multiplex PCR.

Variants of PCR used

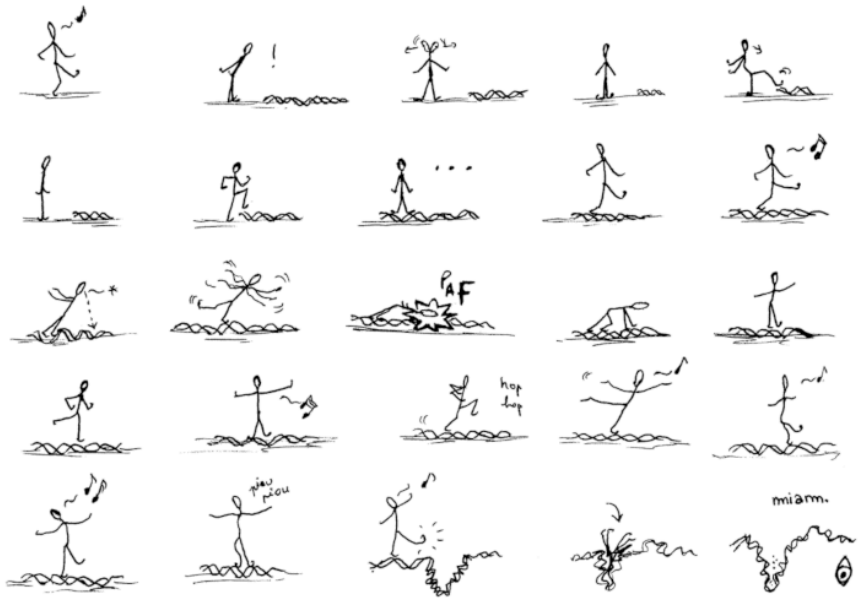
Several types of PCR are used, each with advantages and disadvantages.

- Low Copy Number (LCN) is a DNA profiling method that uses a larger number of cycles for PCR (34 instead of the traditional 28), which makes it both more sensitive to smaller amounts of DNA, and more vulnerable to contamination, among other disadvantages[22].
- Direct PCR is the process of performing PCR without isolation or prior purification of the DNA sample. There is less risk of losing the little DNA present in the sample and less risk of contamination (because there is no isolation or purification), but the subsequent analysis is more time consuming (because there is more chance of ending up with messy mixtures of DNA)[23].

Principles of DNA sequencing

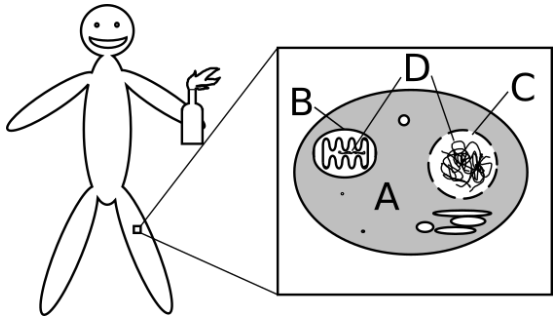
The first sequencing technique invented was the Sanger technique. It uses the principle of chain terminators. A **chain terminator** is a nucleotide that can bind to a nucleotide during replication, but to which the next nucleotide cannot bind.

It starts with the molecule to be sequenced, a large batch of nucleotides, and chain terminator *A* nucleotides (i.e. nothing can attach after them). So there is a very large number of copies of the DNA strand they are interested in, and it will be copied with enzymes. At each position where an *A* must be integrated, some molecules of this very large number of molecules will receive an *A* terminator. Their copy stops there. In the end, we get a lot of partial copies, with an *A* at the end. By finding their length, we can deduce



Once upon a time, there was DNA

A living organism (like you) is made up of cells* (**A** on the following drawing), like the cells that make up your skin. These cells themselves have sub-compartments (e.g. **B** and **C**), which are specialized (in the production of energy, in the export of molecules…). One of these compartments is the nucleus* (**C**). Its role is to protect the cell's genetic information. The medium in which this information is stored is a molecule* called DNA (**D**) for deoxyribonucleic acid. Another compartment of the cell is called the mitochondrion* (**B**), it contains a little bit of DNA too. There are between 0 and 2000 mitochondria in a human cell.



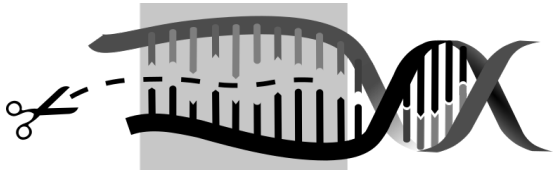
DNA carries genetic information, called the genome*, that is unique to each individual (except for identical twins).

Genetic information and the genome

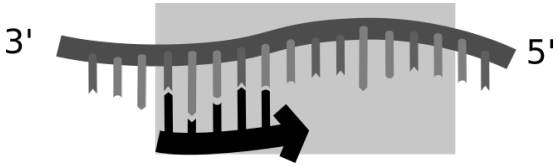
We can visualize DNA as a book. Inside this book, instead of clear sentences, there are sequences of letters. Most of the time, these sequences of letters do not make sense, but sometimes, in the middle, there are words that we understand. For example, we can read :

JVLKHZKHEFLKAEJLKJFA**SMALLBROCHURE**-CLZAEHDFILZAH

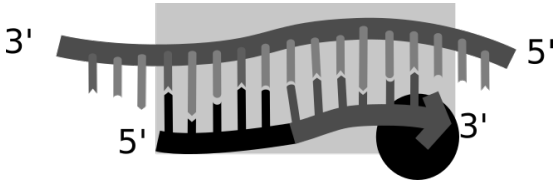
There are sections that have no apparent meaning, which correspond to DNA sequences that are called non-coding sequences.



2. The temperature is lowered to between 50°C and 60°C. At this temperature, the two strands could reassemble (the hydrogen bonds can be reformed). However, there is a large excess of primers compared to the two initial DNA strands. Most of the hydrogen bonds that will be reformed will therefore be between the initial DNA strand and the primer, which is the black strand with an arrow on the following diagram. Here, we have only made the diagram of one of the two initial DNA strands: exactly the same thing happens on the other strand!



3. The temperature is increased to 74°C, which is the optimum temperature for the DNA polymerase. This enzyme will then replicate the DNA by attaching itself to the primers to start its synthesis. The black circle represents the DNA polymerase.



This cycle can be repeated for as long as they like. Starting from one DNA molecule (double stranded), they obtain 2 double stranded DNA after one cycle, 4 after 2 cycles, etc. So they have 2^n double stranded DNA molecules after *n* cycles. The number of cycles is normally 28.

Appendix B: Techniques used on DNA during analysis

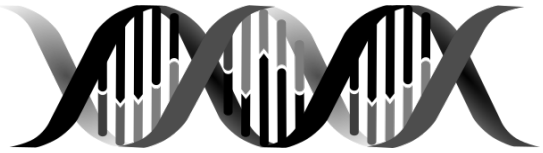
Prior to analysis, DNA from a sample is isolated and purified. In forensic methods, DNA probe techniques are used to pre-test the presence of human DNA in a sample before proceeding with the actual analysis.

PCR (Polymerase Chain Reaction)

PCR is a molecular copying technique. It can be called amplification. During PCR, not all the DNA present in a cell* is copied: the copying selects for a small segment of DNA using the *primers*, which are positioned at both ends of the area to be copied and thus delimit the copying range.

PCR Process

The process begins with a piece of DNA that contains the part to be amplified. It is combined with a large excess of DNA pieces that are a few nucleotides* long (called primers). These primers are complementary to a precise region of the DNA that they want to amplify. DNA replication enzymes* (DNA polymerase) and nucleotides, necessary for the synthesis of a new DNA strand, are also added.



1. At 94°C, the hydrogen bridges between the two DNA strands are broken (the DNA is denatured). In the grey rectangle is the sequence that they want to copy many times (to amplify).

> And in the middle you can read *SMALLBROCHURE*, which is a piece that makes sense. This sequence would code for a trait in the cell. This is called a gene*.

A gene is a portion of DNA that carries a unit of genetic information. The majority of the human genome is made up of non-coding sequences[6], meaning, sequences that are not genes. The genome contains all of the cell's genetic material, both coding and non-coding.

Genes can have several different forms, which are called alleles*. For example, if we imagine that there is an "eye color" gene[7], then several different forms (alleles) of this gene will exist which will be "brown", "blue", "green", "gray", etc.

You can find more details about genes in Appendix A, p. 53.

Structure of DNA

> To reuse our comparison with a book, the information contained in the book is written with the 26 letters of the alphabet. DNA, on the other hand, is written with 4 letters, which are four molecular bases: A, T, C and G.

A strand of DNA is formed from four basic building blocks, the nucleotides*, called A, T, C, and G[8]. The DNA strand is formed from a succession of these building blocks: they form a DNA sequence. The length of a DNA fragment is measured in base pairs, abbreviated as bp*. To refer to a piece of DNA, we can describe its sequence, for example *ATACCACAACATCACA*. If this sequence codes for properties of the cell, it is called coding DNA. The rest of the DNA is called non-coding DNA.

DNA forms a double helix from two single strands of DNA due to base pairing: A always pairs with T and C always pairs with G.

[6] Which is not the same as useless.

[7] In reality, this is not the case: eye color is influenced by several genes.

[8] Adenosine, Thymidine, Cytidine, and Guanosine.

You will find more details about nucleotides in Appendix A, p. 53.

> This book is actually in several volumes, ranging from 1 to 23. Each volume comes in "duplicates", that is, two versions have the same structure (for example, there will be a word on page 3, on the 4th line) but not the same content (not necessarily the same word).
>
> Each volume represents a chromosome*. Each chromosome generally[9] comes in two copies with one chromosome called "maternal" and one called "paternal". For example, XX or XY for the sex chromosomes. Humans generally[9] have 23 pairs of chromosomes. Each individual has 23 pairs of chromosome-books in each cell: we could say that an individual is a library.

The DNA double helix forms chromosomes by joining with other molecules.

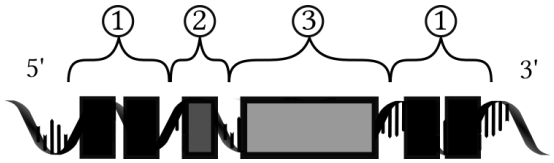
Stability of the DNA molecule

[9]That is, except for when there are more or less than two chromosomes of the same type (such as in the case of trisomy, or monosomy…). For example, for sex chromosomes, you can have XXY, XYY, XXXY…

we age. The STRs at the end therefore serve as buffers that can be shortened at each DNA replication without risking damage to the genes. In short, they prevent our genes from being nibbled at during each cell division.

But here we have talked about the evolutionary uses of STRs, but there are also STRs present that do not contribute anything to the organism that carries them. In fact, at the molecular level, mutations are mostly random and are not selected for their evolutionary value. This is the **neutralist theory of evolution** that was put forward by Motoo Kimura[61]. This is a complete departure from the subject of the zine, but it is quite interesting to see that 50 years after this theory (which is a consensus among biologists) and in spite of genetic drift, natural selection continues to be spoken of at every turn to justify supremacist ideologies by a pseudo-scientific argument of authority.

[61]If you're interested, you can check the Wikipedia page. For a bit of fun: try to reach the "Soda Dam Hot Spring" wiki page as fast as possible from the "Neutral theory of molecular evolution" page, just by using the hyperlinks (I'm at 8 clicks now).



(1) **Regulatory sequences** of the transcription. These sequences give the orders of "hmm, express this gene a little for me", or "ok, stop everything", or "express that a little more please" and so forth. These sequences can be located before and after the gene body.

(2) A **promoter region**, on which the enzyme* that will transcribe the DNA can land.

(3) The **gene body** refers to the part that will be transcribed to make a protein (for example), according to the genetic code: the small dictionary that gives the correspondence between the nucleotides and the basic building blocks of proteins (called amino acids). For example *GGG* corresponds to glycine, an amino acid[59].

Uses (or not) of STRs

In the rest of the zine, we talked about the so-called non-coding STRs. But there are many different kinds of STRs, with different "uses" (or not).

For example, there may be STRs in the actual coding parts of genes, which will result in repeats of the same amino acid in the protein produced from the gene. STRs can also appear in the regulatory sequences of genes (the sequences that say "please express this gene a little more" or "not this one"). The roles we are discussing here are not well understood, to say the least.

There are also STRs at the end of chromosomes[60], because every time DNA is copied (for cell division for example), the chromosomes are not copied to the very end. This is one of the reasons why

[59] This gene body is itself composed of introns and exons, i.e. parts that will not be translated and parts that will be.

[60] Called telomeres.

Let's continue on the subject of DNA-books. The content of these books is rarely modified over time because it is protected (by the cover for example). To make this book unreadable, we try to cut it into small enough parts that we can no longer extract anything from it. For example, if we take the sequence we had before:

SMALLBROCHURE

And we cut it into many small pieces, we get the following: *S*, *M*, *A*, *L*, *L*, *B*, *R*, *O*, *C*, *H*, *U*, *R*, *E*. With just these letters, it is impossible to know if the base text was *SMALL BROCHURE* or *MALL CHORE RUBS*.

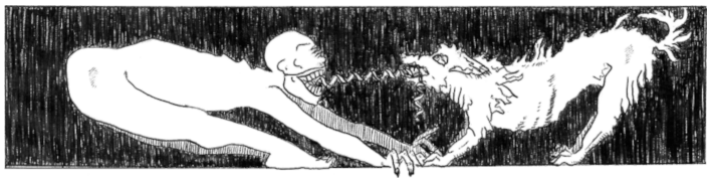
The cover of the book is the proteins that wrap the DNA and protect it, and the nucleus that protects everything. Cutting the DNA to make it unreadable would be equivalent to chemically attacking it, for example.

DNA is a very stable molecule, which means that it doesn't change very easily (whether from mutations or cutting the DNA strand).

All this to say that DNA is robust.

But DNA can degrade, a process through which the DNA molecule is cut into smaller and smaller fragments. Since the information is contained in how the base nucleotides are arranged in relation to each other, the smaller the sequence, the less informative it is.

There is only a single copy of nuclear DNA (contained in the nucleus) in each cell, whereas mitochondrial DNA, as a rule, exists in several hundred copies: it can therefore be analyzed in older and/or more degraded samples.



What are the police up to?

DNA collection by forensic police

First of all, it is important to specify that DNA collection is not an automatic process: sufficient quantities and a degree of quality are required for it to be usable by the cops.

Collection methods at the site

At the site of the action, the cops will use these methods to take the DNA samples to the lab for analysis:

Liquid samples (liquid blood, spit…): They are transferred to a sterile tube, refrigerated and brought to the lab as soon as possible. If the transport time is likely to be more than 24 hours, they absorb the sample with a cotton swab or sterile pad and let it dry.

Solid residue (dried blood stains on clothing…): If possible, the surface under the residue is cut out, bagged and taken away. If it cannot be cut, a sterile swab and sterile water (not too much to avoid dilution) are used to moisten and rub the sample. The cotton is dried and stored for analysis.

Touch DNA (skin cells* inside a glove, cells inside a mask around of the mouth…): The cops rub the area with slightly wet cotton or a swab and store it in a sterile tube.

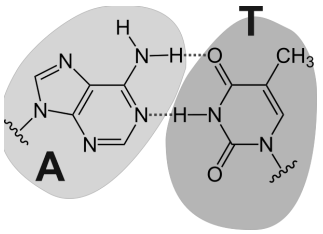
Solid bits (a hair, a piece of skin that is torn off…): These are put in a sterile bag and taken away.

Usable DNA sources

This section is primarily based on *Preuve par l'ADN : la génétique au service de la justice*[1] [DNA evidence: genetics in the service of justice].

a side called **5'** (phosphate group side) and a side called **3'** (deoxyribose side). The DNA strand, which is a succession of oriented nucleotides, is therefore also oriented. This defines a reading direction.

The DNA molecule* itself is made up of two single strands interacting with each other via the complementarity of bases (*A–T*, *C–G*) thanks to hydrogen bonds, thus forming a DNA double helix. In the following diagram, we show the complementarity between the bases A and T.



This double helix is then compacted by proteins[58] to form a chromosome*. This chromosome can itself be protected in the nucleus* of eukaryotes (of which we are a part, unlike bacteria, for example, which belong to… bacteria).

What is a gene?

We are speaking about genes* in eukaryotes, the situation is different in bacteria. A gene is a theoretical unit of heredity. It corresponds to a sequence of nucleotides which codes for a product, which can be either a protein or RNA (Ribo-Nucleic Acid). It is composed of several parts, as seen in the following diagram:

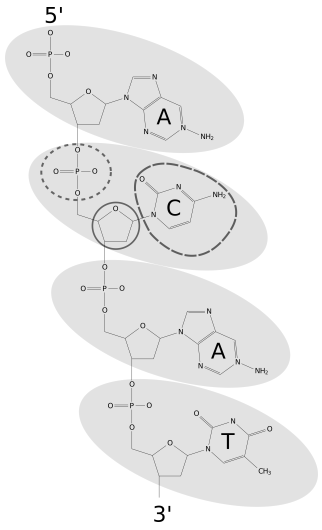
[58] Including histones.

Appendix A: A little more on DNA (it never stops)

Here, we'll go a bit further on DNA, but also a bit faster. If needed (and wanted), Wikipedia articles are very well done on these subjects.

Quick overview of nucleotides

A single strand of DNA is formed by a succession of **nucleotides*** (A, T, C, G for Adenosine, Thymidine, Cytidine, and Guanosine). Each nucleotide (in gray ovals in the following diagrams) is formed of a **nitrogenous base**[57] (surrounded by a long dotted line), of a **deoxyribose** (surrounded by a continuous line) and of a **phosphate group** (surrounded by a small dotted line).



Books have a reading direction: from top to bottom and from left to right. For DNA it is the same. Each nucleotide is oriented, with

[57] Adenine, Thymine, Cytosine, and Guanine.

Blood: Blood is THE biological sample par excellence. All the DNA in blood comes from white blood cells (5,000 to 10,000 cells per µL)[10]. Blood is very easy to analyze scientifically: in theory, any trace visible to the naked eye can be analyzed[11].

Menstrual "blood": Menstrual "blood" is composed of both blood and dead cells of the uterine wall. Apparently[2], this is very useful for genetic profiling.

Saliva: Saliva contains hundreds of cells from the mouth per µL. The DNA from these cells is found on licked stamps for example (a classic). A licked stamp can still be analyzed even after months or years.

Urine: Urine is not a very good source of DNA for analysis, because there is not a lot of DNA in it, and it deteriorates quickly.

Bones and teeth: DNA from bones and teeth is mainly used to identify corpses. It has a good chance of surviving, even long after death, and even if the corpse has suffered significant damage (burned, for example).

Skin samples: Intact DNA profiles can be obtained from direct skin swabs.

Objects in contact with the skin: For example, door handles, car keys, telephones, cup handles, knife handles, shoes, socks, clothing, glasses, hats, Latex gloves, pencils, watches, etc. Success rates for "Touch DNA" analysis are variable, as the amount of biological material left on surfaces varies widely among individuals (dry, clean hands leave less DNA)[3]. The DNA is often in minute quantities and sometimes degraded, so partial DNA profiles are obtained.

Note that smooth surfaces are more likely to feature fingerprints, and rough surfaces are more likely to carry DNA traces (because they scrape cells off for example).

If you touch an object with a gloved hand and then touch another object, you can contaminate the second object with the DNA that

[10] Red blood cells have no nucleus* or mitochondria*, therefore no DNA.

[11] The analysis of a blood sample for DNA identification is very reliable. However, when it comes to collecting samples, their reliability is diminished by the human factor: it is easy to confuse blood stains with coffee stains.

was on the first. More generally, DNA can be transferred from one object to another by contact between them[4].

Hair and body hair: The success rate of DNA analysis in the nucleus of the hair shaft cell is low (< 10%). Indeed, in the hair shaft, there is very little DNA and it is very degraded. Hair that falls out on its own has a root that is also degraded, so there are few or no living cells.

However, hair that has just fallen out or especially that has been pulled out still has its root, and nuclear DNA can be more easily analyzed. In addition, mitochondrial DNA can sometimes be used as a backup, but it is not as good as nuclear DNA for analysis. Non-human hairs can also be used and can be informative![12]

Cigarette butts: Another classic example: the nice cop gives you a cigarette in custody. The chances of a successful analysis are very high. Since products of combustion inhibit analysis, the paper surrounding the filter and the last millimeter of filter are carefully cut out, i.e. the parts in direct contact with the lips and mucous membranes.

Glasses, containers and food: When you drink from a glass, you deposit cells on the rim where you put your lips[13]. This is "Touch DNA" that can be used by the cops.

Stains on fabric: If the stain had time to dry before the fabric is washed, there is a good chance that DNA is still present after washing. In the case of blood, even after machine washing at 90°C the stains can still be analyzed[5]. They are still analyzable after hand washing with soap, dish-washing liquid, or laundry detergent[6].

[12]It is not a good idea to leave the hair of the dog that lives with you at the site of an action.

[13]While in custody: try drinking "wirelessly". This means drinking without contact between the container and your mouth. For an added challenge, don't touch the container with your hand.

polymorphism: Polymorphism characterizes the ability to occur in different forms.

Glossary

allele: An allele is a form of a gene. Here, we use allele in a broad sense: the allele of a STR is the number of repetitions of the repeated sequence.

bp (base pair): This is the unit of length of a DNA molecule, which counts the number of base pairs (paired nucleotides, like *A-T*) that the molecule is comprised of.

cell: The cell is the basic element (structural and functional) of living beings.

chromosome: A chromosome is a long DNA molecule wrapped in a series of proteins that serve to maintain the integrity of its genetic information.

enzyme: Enzymes are proteins that increase the speed of chemical reactions in living beings. They can be compared to molecular tools acting on other molecules (to cut them, bind them, etc.)

gene: A gene is a coding sequence of nucleotides, i.e. it is a unit of information for the cell.

genetic profile: A genetic profile is the result of the DNA analysis of an individual.

genome: All the genetic material contained in a cell, and by extension, all the genetic information of the cell.

mitochondrion: The mitochondrion is a sub-compartment of the cell, which serves as its power plant. There is DNA in the mitochondrion (trace of an ancient symbiosis: the mitochondrion was previously bacteria) that we call mitochondrial DNA.

molecule: A molecule is a group of atoms linked together.

nucleotide: Basic unit of the DNA molecule.

nucleus: The nucleus is the sub-compartment of the cell that envelops the DNA and in which transcription takes place. The DNA in the nucleus is called nuclear DNA.

DNA analysis by forensic police

The basis for genetic profiling is that only twins have identical genomes*. The human genome is more or less the same in everyone, but there are differences that can be used to identify a person (genetic markers).

Genetic markers used by the cops

There are different types of variations between individuals. The ones used by the cops for identification purposes are called **STRs** (Short Tandem Repeats), also called microsatellites.

What is an STR?

> Let's return to our DNA-book comparison and take a closer look at a sequence:
>
> JVLKHZKHEFLFA**HLHLHLHLHLHLHL**AEJLKJS-MALLBROCHUREFILZAH
>
> Here's a sequence in which the pattern *HL* is repeated seven times. The same thing can be found in DNA, for example with repeats of the *CA* pattern. An STR in the above example would be the entire sequence *HLHLHLHLHLHLHL*, consisting of 7 repeats of the *HL* pattern.

In the example above, the STR is located in an area of the DNA that does not make sense (non-coding DNA), but it could also be located in the middle of a part that does make sense (coding DNA). For example, below, the STR is located right in the middle of *SMALL-BROCHURE*:

> JVLKHZKHEFLAEJLKJFASMALL-BROHL**HLHLHLHLHLHLHL**CHUREFILZAH

The STRs analyzed by the cops are located in the non-coding regions.

The different alleles of a STR

> Let's imagine that in all libraries (i.e. in all individuals), in book 4, page 32, 4th line, there is always a certain number of repeti-

tions of the *HL* pattern. In some libraries, at this precise place, there are 8 repetitions of *HL*, while in others, there are 7, 4 or 12, for example.

In individuals, it is the same. Let's imagine a particular STR made up of repeats of the pattern *GTC*, located on the 3rd chromosome*, starting at 2 million base pairs from the end[14] of the chromosome. Some individuals will have 8 repeats of the *GTC* pattern, while others will have 12, or 7 or whatever.

The number of repeats in a particular STR is variable. In the overall population, there may be as many as ten different versions of a particular STR, with each of the alleles* being characterized by a different number of repeats. Here, a broader definition of allele is used: the allele of a STR is the number of repetitions of the repeated pattern.

In genetic profiling, the alleles of a given number of different STRs are determined. For example, by studying different STRs numbered from 1 to 5, the number of repeats of the pattern (i.e. the allele) for each STR can be written as:

16/15(STR1); 15/7(STR2); 13/12(STR3); 5/6(STR4); 8/8(STR5)

For *STR1*, there are 16 repeats on one chromosome and 15 repeats on the other.

For each STR, there are two different possible numbers of repetitions, because there are two versions of each chromosome (called "maternal" and "paternal").

Why STRs are good genetic markers

Forensic requirements for good genetic markers are as follows:

- They must be **stable** over a lifetime. *STRs are carried by DNA, a molecule* that is fairly stable over a lifetime.*
- They must be **resistant to the degradation** that organic structures may undergo. *STRs are rather short (< 300 bp*), so have little risk of being affected by degradation. Essentially, by choosing a*

[14] Let's say the 3' end, more details in Appendix A, p. 53.

quite suspicious. It's better to tidy up calmly before the action than in a panic afterwards if something goes wrong.

Basically, get rid of disposable items. The covering used on the work surface, sponges, hairnets, disposable masks, and gloves all go in the trash in yet another bag. You can choose to keep or get rid of tools that you have used (wire cutters, etc.), and you can decide whether to throw away or keep the acetone and bleach bottles (a bottle of bleach in a bathroom is fine). It can be useful to know what bleach and acetone are used for in a house[55], so you know where to store them in a way that isn't too sketchy, and can be justified if necessary (without going overboard either). If you're going to use water bottles for an action, it is a good idea to get rid of the ones you won't be using. If the cops find your bottles full of gasoline out in the world, you'll feel better if there is no risk of them finding the same bottles full of water in your home.

The only thing left to do is to know what to do with your big garbage bag with all the stuff in it[56]. Don't just put it in your kitchen or building's garbage can. A quick trip around town or on the road and you'll be able to find a dumpster a ways away from where you did the cleaning that will be great for getting rid of your waste. Be careful, however, if the case is serious, the cops will search the garbage cans around the place of the action or around the homes of the suspects, so put more than two or three streets between you and the compromising material. Another radical solution: the campfire (be careful, acetone is very flammable, do not burn the bottle). Do this quietly, away from people who get offended when plastic is burned.

[55] Bleach for bathroom type surfaces, acetone to strip paint or remove glue, so more like a tool shelf or garage…

[56] *N.T.P. note:* We recommend that you separate the garbage into different bags as much as possible, so that the contents of each garbage bag look like they have a legitimate reason to be together and don't look too sketchy. This is useful in case a concerned citizen or the cops find one of the bags and open it. For example:

- You can put materials that could be used by house cleaners, materials that could be used by campers, and clothing in three separate bags.
- You can put the materials used to build the incendiary device in separate bags (e.g. the jerrycan in one bag, the firecracker packaging in another).

short sequence in a DNA molecule, there is less chance of degradation than if the sequence is longer.

- The **analysis technique** required must be sensitive enough to apply to minute traces. *This sensitivity is what has improved the most in the last 20 years.*
- The **cost** of the analysis must not be prohibitive. *See "Costs of a DNA analysis", p. 26.*
- There must be enough **polymorphism***, i.e. enough variation in the population, for the marker to be useful for identification. *STRs have many alleles, i.e. many variants.*

How is it analyzed?

The sample is first **purified**, meaning it is cleaned to keep only the DNA (all other substances are removed).

Then, the collected DNA is **amplified**, which means copied several times. This is done using PCR[15]. PCR (Polymerase Chain Reaction) is a molecular copying technique. It is also called gene amplification. During PCR, a piece of DNA is selected and copied millions of times.

After PCR, the products are **examined** by gel electrophoresis[15]. Electrophoresis is a technique that separates molecules by differences in their mobility within an electric field. For example, the more positive charges a molecule has, the more it will be attracted to the negative pole in an electric field, so the more it will move.

In gel electrophoresis, the molecules move in a gel: the larger they are, the less they move because the gel hinders their movement.

There are therefore two parameters that allow molecules to be separated in gel electrophoresis: their charge and their size. Since gel electrophoresis allows separation according to the size of the molecules, it can therefore determine the size of a piece of DNA by comparing its migration with the migration of pieces of DNA of a known size.

[15] There is more information on PCR and DNA analysis techniques in Appendix B, p. 57.

This technique is used for several STRs (multiplex analysis[15]). This provides a sample's DNA profile*. Another widely used test is to determine whether the sample contains a Y chromosome.

The DNA profile that is obtained corresponds to the number of pattern repeats in a given number of STRs (15 STRs for the analysis kit called ABI used in France, for example), see the table in the section "The genetic fingerprint kept by the cops", p. 25. We are not going to dwell here on the calculations that courts use to determine whether an analysis relying on a certain number of STRs is a sufficient basis to confirm an individual's identity. This is detailed in the zine *L'apparence de la certitude : l'ADN comme "preuve" scientifique et judiciaire*[3] [The appearance of certainty: DNA as scientific and legal "proof"].

What influences the success of collecting the genetic material from the site?

The amount of DNA found at the site

The recommended number of cycles in PCR is 30. This allows a satisfactory DNA profile to be obtained from 0.5ng[16] of DNA. Considering that we have about 0.006ng of DNA per cell, it takes the genetic material of about 100 cells to obtain a profile (in 2006)[1].

We will use these numbers for our calculations, but **the amount of DNA needed for analysis is decreasing all the time** (as we said, progress doesn't stop)[4].

There are different amounts of DNA in different sources:

- In one mL of blood, there is about 30,000 ng of DNA. It takes at least 20 millionths of a mL to do a DNA analysis that gives a satisfactory result. This is smaller than a small drop of water.
- A sample taken directly from the skin of the hand yields between 2 ng and 150 ng of DNA (on average 50 ng). Dry or recently washed skin will yield less DNA than other skin[7].

[16] One ng (nanogram) represents one billionth of a gram.

Passing packaged material to others

Once the material has been correctly packaged, it might need to be carried or given to others.

Let's imagine: Danny and Casey have prepared a clean molotov cocktail and packaged it in an airtight bag. It is Bibi who is going to use it. So Casey or Danny will have to give the package to Bibi. Bibi will end up with a package containing an incriminating object inside and possibly Danny's or Casey's (or others') DNA on the outside. If the cops find Bibi in possession of this package and analyze the DNA, they will obviously link Bibi to the cocktail (but for that no DNA is necessary, it's a flagrant crime), but maybe also Danny and Casey if their DNA is on the outside of the packaging!

How to make sure that the package Bibi receives does not contain Danny and Casey's DNA?

When Danny meets Bibi to pass on the package, Danny opens the first bag and Bibi takes the bag inside without Danny touching it. So the package will only contain Bibi's DNA on the outside. If Bibi gets caught with it, the cops will only find their DNA on the package and not that of other people. This is compartmentalization in practice.

The object must be packaged with at least one layer and as many additional layers as there are people in the transmission chain. If Danny gives it to Bibi who then gives it to SuperTomato there need to be three layers of packaging.

6. Pack up the work area, put away what has been used

After the cleaning session, it is necessary to put everything away. A work surface that hasn't been cleaned up is an additional trace of your action. Cops coming across a table covered with gloves, a bottle of acetone, wire cutters, sponges, a funnel (etc.) will make them

during the cleaning process, we would recommend replacing them with new ones rather than attempting to clean them.

Our own traces, other people's traces: There are two reasons why it's good to make sure that we don't leave our own traces, or those of others, on action material. The first: it's bad solidarity to leave the traces of other people (friends or enemies, giving people to the cops is not classy). The second: if our roommates or an employee of the supermarket around the corner are identified by the cops, well, it gives the cops clues that could lead them to us.

Now that your item is properly packaged, it will not be recontaminated during storage or transport. The outer packaging will be instead. And you can put multiple layers on top of each other, only the outer packaging will be recontaminated.

In concrete terms, when you put your garbage bag in your backpack, the traces that are present in your backpack will contaminate the outside of the garbage bag. This means that if you dispose of the bag in an emergency, it may contain DNA traces. That's embarrassing. So you could keep the outer bag and dispose of its contents. If you used two bags, it might be more practical. It's obviously not easy to quickly open a garbage bag to dump out its contents.

The general idea is that you want to keep the contaminated objects/tools/packaging with you and you can dispose of the non-contaminated ones as needed.

I screwed up, boss! If a glove breaks during the cleaning, Casey spits on the hammer, shits on their work surface (or whatever, to your heart's content), don't panic.

Put the contaminated items onto the dirty work surface, change gloves and, if necessary, change the work surface (back to square one) and start again[54].

[54] *N.T.P. note:* Again, in keeping with the idea that preventing contamination in the first place is just as important as cleaning, if materials are contaminated

- One mL of saliva contains about 2,000 ng of DNA. Therefore, it takes at least about one millionth of a mL to do a satisfactory DNA analysis.
- One hair root yields up to 200 ng of DNA.
- In one mL of urine, 10 ng of DNA can be found.
- One mg of skin or muscle contains about 3,000 ng of DNA.
- A swab from objects held regularly by an individual yields between 1 ng and 100 ng of DNA[7].

When cops have only a few cells available, the analysis is much more vulnerable to random effects that do not reflect reality. For example, consider 3 cells containing the A and B alleles of a given gene*. When these cells undergo a degradation, the B allele does not survive. Only the A allele remains each time. The cops collect a sample and analyze it. They obtain a profile where only the A allele appears, so their interpretation will necessarily be incomplete. This is called an *allele drop-out*.

Even if we always leave some DNA, it is worthwhile to leave as little as possible, it is not a question of all or nothing.

Preservation conditions of the collected DNA

General considerations

DNA can be degraded before it is collected or after if it is poorly preserved by the cops who collect it[1].

In order to do analyses, they need at least a few fragments of DNA several hundred base pairs long (nucleotides*). However, several environmental factors can degrade DNA (break it):

- Some **enzymes*** present in the environment can cut DNA, for example enzymes produced by bacteria, or fungi present in soil. They work best at a certain temperature.
- **Humidity** provides one of the ingredients (water) needed to break the bonds between the nucleotides that form the DNA chain. Water is necessary for DNA degradation enzymes to act. Finally, water allows the growth of bacteria and fungi that reuse

pieces of the molecules in the sample to make their own molecules (including DNA)[17].

- **Heat** is one of the elements that accelerate chemical reactions that require energy, which include DNA degradation reactions.
- **Light** (especially UV light) chemically transforms DNA. Some skin cancers are linked to UV, for example, because UV tends to mutate DNA.
- We quote: "Of course, **other aggressive chemical substances** (acids, bleach…) can also attack DNA molecules. But these substances are unlikely to be encountered at crime scenes." We'll expand on that a bit later, precisely in order to leave some at the site[18].

Outdoors, the sun and rain leave little hope for biological traces to last beyond a few weeks to a few months. If the area where the DNA sample is left has significant microbial life (e.g. undergrowth, soil, stagnant water…), this lifespan decreases further. A hammer left in the undergrowth in the middle of summer (enzymes, humidity, heat) will keep less DNA than if it was left in winter on concrete.

Moreover, to take saliva as an example, when it is not dried, the humidity and the enzymes present rapidly degrade the DNA (in a matter of hours or days)[1].

[17] *No Trace Project (N.T.P.) note:* The impact of the exposition of DNA to water should not be overestimated. A study found that "DNA could still be recovered from clothes exposed to water for more than 1 week". In the study, complete DNA profiles were obtained after the immersion of clothing for one hour in a river in summer, as well as for two weeks in a pond in winter[8].

[18] *N.T.P. note:* This zine doesn't end up discussing leaving aggressive chemicals at an action site. If you know you need to touch a surface during an action (e.g., a door handle, the cover of a fiber optic manhole), you can:

- Bring bleach in a spray bottle to apply to the surface after you interact with it.
- Take steps to avoid contact with a surface in the first place. For example, if you need to climb into a fiber optic manhole, your clothing is likely to come into contact with the ledge: you can bring a new shower curtain, place it on the ledge when you climb into the manhole, and take it with you when you leave.

See footnote 35, p. 37 for more information on DNA contamination during an action.

5. Package the material for storage or transport

Often, there is some time between cleaning and the action. You want to make sure that the material is not recontaminated between its preparation and its use. As a silly example, if you have cleaned your hammer of fingerprints and DNA traces and you leave it lying around your living room, it is likely that people will hold it with their bare hands, and so will leave their fingerprints or DNA traces on it. If the material is not properly packaged to avoid recontamination, cleaning it was useless.

Packaging cleaned material

To package all this, you will need uncontaminated, airtight and sufficiently resistant packaging (depending on the object to be packaged). For example: freezer bags, garbage bags, tupperware, jam jars… Depending on the size and shape of your objects, you will use different packaging. For example, a 20 L garbage bag will suffice to package a hammer, but not a 24″ bolt cutter. For smaller objects, you can use freezer bags with a zip, which are usually sold in a cardboard box. To use them, Danny opens the box, and empties its contents onto Casey's work surface, without touching the freezer bags. For objects that could pierce a plastic bag, a decontaminated tupperware can be used[53].

A decontaminated object on Casey's work surface is ready to be packaged. To do this, Casey uses clean packaging and places the object in it. Casey is careful to not have their face above the packaging, so as to avoid dropping hairs, pieces of skin, etc.

With garbage bags, Casey holds the bag at arm's length so that nothing falls in. We prefer simple bags, without built-in handles or other gadgets. To close the bag, you tie a knot with the bag or use its plastic tie. To obtain a garbage bag that is considered uncontaminated, proceed as explained in the section on preparing the work surface.

[53] *N.T.P. note:* We recommend using uncontaminated tupperware that comes in packaging. Tupperware also provides structure to the packaging, unlike bags, which is important for fragile things like the delay of an incendiary device.

"Short Tandem Revenge. With Casey Clean and Danny Dirty. Guest-star: Bleach."

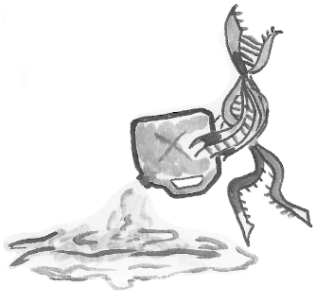
The bottles of acetone and bleach are probably contaminated[50], so it is Danny who picks up the bottle and pours the liquid onto Casey's sponge. The same goes for the gas jerrycan[51]. Danny can also clean the bottles with bleach so that Casey can use them afterwards. Or we can put a basin full of bleach on the table. You can then wash your gloves in it and/or soak your sponge in bleach[52].

[50] *N.T.P. note:* We recommend using a new bleach bottle. This minimizes the risk of contamination of the bottle with DNA, and ensures that the sodium hypochlorite works as intended (sodium hypochlorite is not very stable and will work less well over time, in particular when exposed to light, air and heat, among other factors).

[51] *N.T.P. note:* You can also use a new jerrycan. Choose the smallest one that will hold the volume you need to make it easier to transport.

[52] *N.T.P. note:* Using a basin is better than Danny pouring bleach directly onto a sponge because it minimizes Danny's proximity to Casey's work area (the "clean" one). When Danny pours the bleach, the basin can be near the edge of Casey's work area, so Danny doesn't need to hold anything directly over it. Contrary to what is said here, Casey shouldn't touch the bleach bottle, and they won't need to if there is a basin. It might be easier to acquire a new tupperware in packaging than a new basin in packaging.

To be properly stored, DNA must be dry, cold and protected from light. To give an idea, the recommended storage conditions for forensic samples are room temperature and low humidity for dry samples, and −20 °C for liquid samples.



A specific example: dried bloodstains

Here, we will summarize the results of an article studying the degradation of DNA in dried bloodstains[9]. It is interesting because it provides orders of magnitude of DNA degradation time. Nevertheless, these should be taken with caution, for two reasons:

- Laboratory conditions are different from those found outside.
- The DNA fragment sought by the authors is a precise sequence that is 273 bp long, whereas the STRs used by the cops are generally shorter. They therefore degrade more slowly, which would suggest that we should consider these orders of magnitude as a bare-minimum.

The results of the study are:

- Below 35°C and at less than 100% humidity, DNA degradation is negligible over the course of a year.
- For these same temperatures at 100% humidity, there is microbial growth, and various bacteria and fungi degrade the DNA. It remains analyzable for a few months (about 4 months, with large variations, for fragments of 273 bp).
- At temperatures above 45°C, no microbial growth is observed. At 45°C, the DNA remains analyzable for a long time (at least 8 to 9 months). At 55°C and 65°C, the stability of the DNA re-

lapses, and after 3 months, the researchers cannot find the 273 bp fragment they were looking for, despite the absence of microbial growth. At these temperatures, spontaneous reactions[19] degrade the DNA molecule.

In conclusion: Under standard climatic conditions, the degradation of DNA in a dried bloodstain is mostly impacted by microbial growth, which occurs at high ambient humidity levels. So if you want to leave materials behind, do it in a damp undergrowth rather than on a vacant lot, even in the middle of summer. That said, keep in mind a DNA analysis may still be successful.

Analysis of samples containing DNA from multiple individuals

The analysis of samples containing the DNA of multiple individuals is a major challenge for police DNA forensics[10].

It is also a field where lots of research occurs and progress is quick. We will give a small update on what we know about the current state of affairs.

In 2005, there was a study that showed that, on the same sample of mixed DNA, the Experts (with a capital E) did not all come to the same conclusions. What a shame[11].

There are three important factors that influence the success of an analysis of mixed DNA[12]:

- How many individuals contributed their DNA to the mixture? (the more people, the more difficult to analyze)
- How much did each individual contribute to the mixture? For example, if one person contributed a lot, and the others just left a very small amount of DNA (see first graph after this), it will be easier to analyze than if everyone contributed about the same amount (second graph). Also, the smaller the amount left by each person, the harder it is to analyze (third graph).
- How degraded is the DNA? (as usual)

[19] Called hydrolysis.

Danny can start cleaning the tools and objects with acetone, as well as the bottles of acetone and bleach. Danny is very thorough with the sponge, and makes sure to go all over the object, so that its entire surface has been cleaned with acetone[28]. Once the object is finished, Danny puts it on their work surface (the "dirty" one). Then Casey takes this object and rubs it with bleach, using a different sponge (being thorough once again). Once the object is clean, Casey puts it back on their work surface (the one for decontaminated object-s).To return to the molotov example, once the bottle filled with gas is cleaned, Casey can attach the firecracker (that has been removed from its package and placed on their work surface) with a zip-tie (which had the same treatment). The molotov that results is clean; the contaminated parts (the bottle) have been cleaned and uncontaminated parts (the zip-tie, the firecracker) have been added[49].

even with clean tweezers. In this case, Danny dumps the component onto Casey's work area, trying not to shake the packaging—in this option, it is important that the packaging is clean, as it will be positioned above Casey's work area. You should avoid contaminating this packaging in the first place, see footnote 41, p. 41. Airtight plastic packaging can also be cleaned with bleach before being placed above Casey's work area.

[49] *N.T.P. note:* As we explained in footnote 47, p. 43, we disagree with this approach because **Casey should never touch contaminated objects**, and **Danny should never touch the molotov components**, only their packaging. At no point should the device components touch Danny's work area (the "dirty" one) or Danny's gloves.

Instead, using this molotov example:

- Danny should only touch the packaging of the plastic bottle, the packaging of the funnel, etc. Danny's work area is only used when Danny needs to apply bleach to packaging, which should happen when there are components that need to be dumped on Casey's work area (the "clean" one) because Casey cannot remove the component without touching the outside of its packaging.
- Casey should only touch the uncontaminated components and tools and arrange them on their work area. Once everything needed is on Casey's work area, Danny pours the jerrycan of gasoline, while Casey holds the bottle and funnel steady. Casey then cleans the plastic bottle with bleach because the packaging around water bottles is usually not airtight. Casey then attaches the firecracker to the bottle with zip-ties—the firecracker is uncontaminated, so it doesn't need to be cleaned, and the bleach might damage it anyway. Casey then packages the finished device in clean bags.

cardboard boxes when they are sold. These include cleaning gloves, sponges, syringes, etc. It is very important to ensure that uncontaminated materials are used. Materials that are obtained from the store and packaged tightly (as long as precautions have been taken in how to store them after the purchase) can be considered uncontaminated.

Danny will rub the metal objects with sandpaper[45] and then use a sponge soaked in acetone to clean all the objects of fingerprints[28]. Casey will use another sponge[46] soaked in bleach to clean the objects of DNA traces[47]. Note that bleach damages metal objects (especially steel objects, which will rust). It's good to keep this in mind, the life span of a bolt cutter that gets bleached once a week will be short. You have to scrub, and put a lot of cleaner: for example, the longer you leave the bleach on, the more the DNA will be degraded. It can be a good idea to put a lot of bleach on, and for it to be left to dry by itself for 15 minutes so that you don't get bleach everywhere.

Danny opens the package containing the sponges (without touching them) and Casey removes a sponge out of the package (without touching the outside of the package)[48]. Casey uses this sponge for the bleach. Danny will use another one for the acetone.

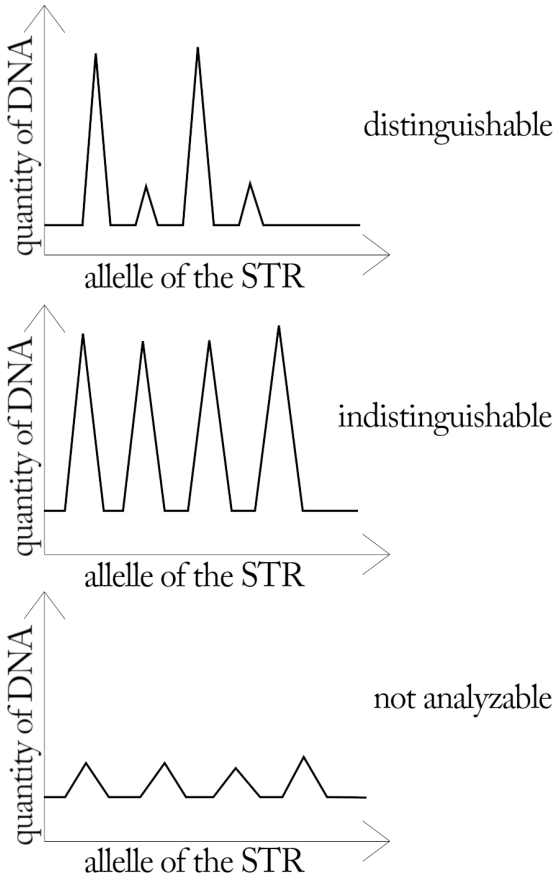
[45] As a reminder, acetone is not always sufficient to clean metal objects.

[46] *N.T.P. note:* We recommend using a new sponge per item, so as to not rub the same surface across distinct materials.

[47] *N.T.P. note:* Casey should apply bleach to materials that have never been contaminated, such as the plastic bottle used in an incendiary device. But because Casey must *exclusively* touch clean objects, Danny should actually be the one to apply bleach to materials that may have been contaminated, such as the outside of packaging or any contaminated metal objects.

[48] *N.T.P. note:* There are two options to remove components from their packaging:

- The first option is described here and is preferred because it is more controlled and because the packaging and Danny's gloves don't need to be above the work area. When nurses need to do this in the context of wound care, they use clean tweezers to make it easier to not touch the packaging.
- The second option should be used when it is too difficult for Casey to remove the component without touching the outside of the packaging,



This area has advanced a lot, with new standards and statistical tools to address it. Their tools aren't amazing, but be careful anyway. It all depends on your situation: if you want to anonymize your spoon in custody, you can have it licked by all your fellow inmates, but if you're outside of State captivity, there are more suitable means that we will develop later on (see "The spit, the lighter, the rear-view mirror and the incendiary device", p. 28).

There are several steps to analyze a DNA mixture:

1. First, identify that it is a mixture.
2. Find the peaks of alleles (like on the graphs).
3. Deduce the number of potential individuals whose DNA is included.

4. Find the contribution ratio of each individual to the mixture.
5. Find all the possible genome combinations.
6. Compare with DNA profile databases.
7. Pray you didn't screw up (apparently, this is important).

Location of the collected DNA

This part has nothing to do with the quality of the analysis itself, but rather with the conclusions that cops or judges can draw from it. The link between the source of the sample and the location where it was collected is what makes DNA evidence incriminating.

Blood, for example, whether found around or at the site of the action, is considered robust evidence. Unlike a cigarette butt, which, if found with your DNA 50 yards from a bank that was trashed, is less incriminating than your blood on the ground in the same location. So for DNA sources other than blood, there is a significant difference[13] between if they are found at the site or elsewhere.

This means that transportable (or mobile) sources of DNA (e.g., hair blown in the wind, bits of skin left on an abandoned bag in the street) are weaker evidence than others (like blood).

We are not saying that if a judge wants to lock you up and his only evidence is a cup with your DNA on it found 100 meters from the site of the action, he will not do it. It's important to keep in mind, however, that just because the cops collected your DNA doesn't mean you're fucked. **What they want most of all is a confession, and DNA may very well be all they need to get it.**

The genetic fingerprint kept by the cops

Once a saliva sample is taken by a cop (a cotton swab inside your cheek), it is packaged and sent to a laboratory for analysis. Once the analysis is finished, the extracted DNA profile is presented as a table.

For this phase you will need the following material:

- A bottle of acetone[28].
- A bottle of bleach[42].
- Sponges or dish cloths in sealed plastic packaging.
- Sandpaper[28].
- And then… the objects to be cleaned (bottles, pliers, hammers, alien spaceship, etc.)

By "cleaning objects" we mean: "ridding the objects of DNA and fingerprints that might be on them". For an action you may need to prepare some material, and you'll want this material to be able to be left behind in the case that something goes wrong. If the material in question is clean (i.e. without fingerprints or DNA) you will be a little more comfortable with the idea of the cops coming across it[43].

During this phase, you clean the objects needed for the action itself, and also the tools you might need to prepare the device: a funnel, pliers, scissors, etc[44].

If the device is going to require some assembly, you will do it in this phase. For example, if you want to prepare clean molotovs, it is convenient to do the assembly and the cleaning at the same time.

> **Note on industrial packaging**: Some industrial products are packaged in plastic bags or **airtight**

airtight packaging after you leave the store, see "Packaging cleaned material", p. 46).

- If you shoplift the component, you can place it in appropriate packaging while in the store.

[42] *N.T.P. note:* You'll also need a container to pour the bleach into.

[43] *N.T.P. note:* That said, it's not possible to definitively say that something is free of DNA traces, only that there is a low risk that it is contaminated with DNA. If you're planning to use an incendiary device with a delay, you can't be sure that the device is free of DNA. For this reason, you'll want to make sure that the delay is extremely reliable and that the device is unlikely to be discovered before ignition.

[44] *N.T.P. note:* This suggests that you prepare the device with dirty tools that you clean. This puts too much faith in the cleaning process. Instead, we recommend that you use new tools that you haven't used before.

not very contaminated to begin with reduces the risk even further.

The two pillars for security in relation to DNA are: **cleaning** and **not contaminating**.

To take a concrete example: a hammer to break things in a riot. There is a difference between a hammer that is lying around in the workshop at home that is often used and by many different people (therefore highly contaminated) and a hammer dedicated to rioting that is stored in a clean garbage bag, high up in a closet, handled with gloves (so not highly contaminated). Even if you always clean the hammer before going to a demo, the second one is less likely to contain traces if the cops analyze it.

It's the same for plastic water bottles. You can get them from the store in a pack, packaged in plastic. If you carry the bag by the handle, the risk of contamination of the bottles is greatly reduced[41].

[41] *N.T.P. note:* The protocol detailed in this zine does not sufficiently align with the principle of never contaminating materials in the first place. For example, let's say you want to build an incendiary device without leaving DNA traces on it. As you build the device, you intend to clean its individual components, which is a good safety precaution. But the cleaning process is not 100% reliable, so it's very important that **you avoid contaminating the device components in the first place**. In particular:

- You shouldn't use acetone or sandpaper to remove fingerprints from a component, because you should be sure that the component has never been in contact with your skin at any point in time.
- When you obtain a component, it should come in airtight packaging whenever possible.
- Ideally, you can avoid contaminating a component's packaging. If there is DNA on a component's packaging, there is an increased chance that this DNA transfers onto Casey's work area when Danny opens the packaging. To avoid contaminating a component's packaging:
  - If you buy the component, you can use another item to push it into a shopping basket without touching it directly, and ask the cashier to bag it for you (if the bag can't be tied, you can add another layer of

D3S1459	vXA	D16T546	D2S531	TPGX	DYS131	CTFIPO	D15S443	THO3
18	13	10	9	12	13	12	8	23
17	15	13	12	11	12	10	11	18

An imaginary example of a genetic profile in the police DNA database with 9 STRs studied. In the first line there are the names of the STRs that have been analyzed. The two bottom lines indicate the repetitions of the pattern on each chromosome.

What the cops are recording is a sequence of numbers that they hope is unique to each individual. It is not the piece of cotton swab that was used to take the sample. By refusing to give a DNA sample, you refuse to improve the police's knowledge of our genetic information. Every DNA sample taken by the police is a measurement of tiny parts of the genetic information contained in your DNA and not a complete picture. Even if you've already been swabbed, giving another swab means the cops are storing new information about your DNA. If I was already swabbed in 2016, how do I know if the STRs analyzed today are the same as in 2016? Was the accuracy of the analysis in 2016 as effective as it is today?

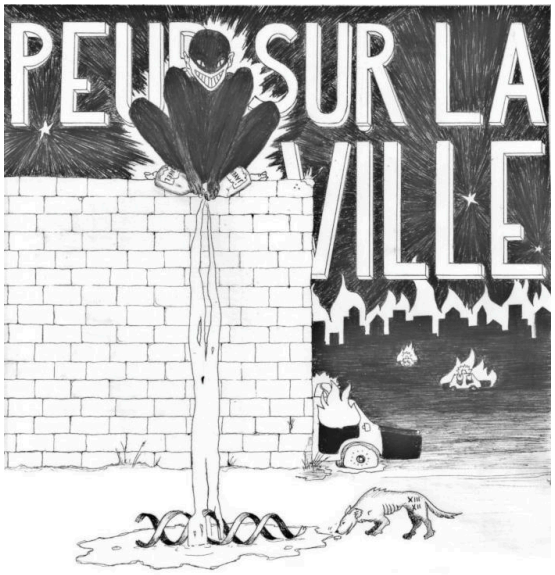
When in doubt, it's always best to refuse a sample even if you think your DNA has already been collected in some way[20].

Costs of a DNA analysis

The costs we saw were between 30 and 80 euros for a swab analysis, and around 350 to 420 euros for the analysis of "unconventional samples", such as DNA on a T-shirt. Note however: we have mostly seen 80 euros in the quotes (rather than 30 euros) for swabs, and mostly seen 350 euros (rather than 420 euros) for unconventional samples.

This information concerns analyses performed in 2018 and 2019.

[20] *N.T.P. note:* Although it is sometimes possible to refuse DNA sampling in France, in many countries this is not possible, and cops will simply take your DNA by force if you refuse to comply.



"Fearful city"

uncontaminated objects on their work surface. Whether it is clean objects needed for the action, or tools that will be used by Casey during the cleaning. Casey also unrolls one or more bags to make a separate work surface for Danny.

You can set up a work surface on the floor, even if it is not very comfortable, or you can use a large table or a plank on trestles. Be sure to give yourself enough space to work and don't hesitate to make a work surface with several bags if necessary. Basically, the more comfortable you are, the less likely you are to make mistakes.

4. Clean the material you want to clean

Reducing risk: The truly clean material is the one that has never been contaminated. To put it another way, there is no such thing as zero risk, there is no such thing as cleaning that is perfect and 100% reliable.

For this process, we use products that are supposed to remove the traces we want to get rid of. But there is also a reason to use material with little contamination, simply because it will be easier to clean. Everything we're proposing here is aimed at reducing the chances that the cops will find usable traces. Cleaning is good. Cleaning objects that are

or push back your hair (advantage of wearing a cap and having already tied the hair back if necessary). If Casey has to wipe their forehead or scratch their nose, Danny will do it, and will then change their gloves.

3. Prepare a surface, a work area

The idea is to have a clean work surface to be able to put the cleaned material onto it and which will not recontaminate the material afterwards. For this you will basically need garbage bags[39]. You can assume that the first bag on the roll is contaminated, and that the following bags are clean. You will use garbage bags (rather large and thick) as sheets to cover the chosen work surface. You can also use an actual tarp. If it comes well-packaged from the store[40] in a plastic bag, it can be considered uncontaminated. To get clean bags:

1. Use a new roll of garbage bags (e.g. 100 L).
2. Danny removes the packaging.
3. Danny takes the roll by the ends and unrolls the first bag.
4. Once the first bag is unrolled, Casey takes the roll (without touching the first bag), and Danny pulls on it to separate the first bag from the roll.
5. Casey can use the following bags and consider them clean.
6. Danny can use the first bag to make a work garbage can (packaging, used equipment, etc. can be thrown into this).

Once the first clean bag is separated and laid down onto the work surface, Casey can put the rest of the whole roll on it. So, when Casey needs a bag, Casey takes the roll and separates a bag, and can consider the bag uncontaminated. The idea is that Casey only puts

When not using your hands, keep your arms partially outstretched to your left and right, away from your body and mouth (this is also a better resting position than outstretched in front of you). If you only allow yourself to alternate between these two positions, your gloves won't touch your clothing.

[39] *N.T.P. note:* Instead of using garbage bags, we recommend using new, individually packaged shower curtains, which are larger and thus more convenient than garbage bags.

[40] On this subject, see "Note on industrial packaging", p. 42.

The spit, the lighter, the rear-view mirror and the incendiary device

DNA can be left at the site of an action in four ways.

Let's imagine. Bibi goes on the attack. The plan: to torch a Porsche on December 31. Bibi places an incendiary device, touches a rear-view mirror with their dirty gloves, spits to relax, and while fleeing under stress, drops their lighter.

At the site of an action, DNA can be deposited directly by falling from our body (the spit) as well as by touching objects (the gloves on the mirror), or DNA can be transfered to the action site via material that is left there intentionally (the incendiary device) as well as material that is lost (the lighter).

So there are two points: DNA that we directly deposit at the site in the moment, and DNA that we transfer there via the material we bring.

Directly depositing DNA at the site of an action

As we have seen, we can let DNA fall from us in two ways. It can fall directly from the body (spitting), or be deposited through contact with objects at the site (the mirror).

DNA is contained in cells* that fall from our body, such as hair, blood, dead skin. These traces can be transmitted from one object to another. Textiles such as wool or large-mesh fabrics allow dead skin to pass through and are very good at picking up the DNA of the people you rub up against (including yourself)[21]. They should therefore be avoided. A windbreaker is a better idea.

[21] *N.T.P. note:* A study found that when a person touches clothing for as little as two seconds, they can leave enough DNA on it that if the DNA is collected and analyzed, a complete profile of their DNA can be obtained[14].

The mirror: If Bibi uses their everyday gloves to go to a riot or action, they increase the chances that their gloves will be covered with dead skin cells that will be left along their path; on their lighter, on a fence or a window, on every object they touch. To reduce this risk, you can use a freshly washed pair of gloves that have not been lying around in a backpack or in a laundry bin. Or even a new pair of gloves[22].

The spit: To reduce the amount of DNA that falls from the body, during the action we try to be well covered, from head to toe, with clean clothes (machine washed, for example[23]). This minimizes the risk of hair or pieces of skin falling onto the ground. Avoid leaving your body fluids on or near the site of the action: pee, saliva, etc.

Clean your material before going into action

DNA and fingerprints can be left on material that is taken into action and left behind (the device) or lost near the location (the lighter). There are ways to clean your material in advance to limit the risk of being identified by DNA or fingerprints.

Fingerprints and acetone

The issue of fingerprints is not the main focus of this zine, but we will talk about it very briefly. The contact of our fingers with an object leaves a layer of fat (which comes directly from our skin) on the object. This layer takes the shape of the patterns on our fingertips, and two different individuals have different patterns on their fingertips. Forensic cops are able to pick up these prints on objects and can thus identify people.

[22] *N.T.P. note:* We recommend using a new pair of gloves rather than a freshly washed pair.

[23] *N.T.P. note:* We recommend using newly acquired clothes rather than machine washed clothes. A study found that the "laundry process does not remove all the DNA from washed items"[15].

How to properly put on your gloves?

The gloves must be in individually sealed bags in order to be considered clean. Before putting on the gloves, you should have already washed your hands well, and dryed them well with clean paper towels, for example (avoid shower towels that have not been washed for 6 months). Having short nails isn't a bad idea, if possible (cleaner and avoids damaging the gloves). To have clean gloves, it is important not to touch the outside of the gloves with your hands. So you will pinch the inside of the left glove with the right hand, and put the left hand into it (if right-handed, otherwise reverse), then pinch the inside of the right glove[36] with the left gloved hand and put the right hand in. There are videos on how to put on sterile gloves for nurses on the Internet that can help. Clean the gloves with bleach[37].

It is important to wash your gloves with acetone[28] and bleach if you have doubts at any point. Even if no mistakes have been made, they can be washed with bleach from time to time. In addition, changing acetone-soaked gloves during a long cleaning session can be helpful (being careful not to contaminate anything during this time).

Once gloved, people should not touch themselves, especially Casey[38]. For example, be sure not to wipe sweat from your forehead

[36] *N.T.P. note:* You actually want to pinch the outside of this glove, otherwise you risk your currently gloved hand touching your wrist. In other words: your skin only touches the inside of the glove, your gloved hand only touches the outside of the glove.

[37] *N.T.P. note:* Note that the surface of the glove must remain wet with bleach for approximately 15 minutes for it to be fully effective.

[38] *N.T.P. note:* To minimize the risk of contaminating your gloves, you can use a posture adapted from surgical procedures throughout this protocol. When using your hands, keep your arms extended, ideally no lower than your chest.

You have to keep in mind that DNA traces can be transported by simple contact. So if you touch a contaminated object with your gloves, and then touch another object, you can contaminate it, i.e. transmit DNA traces onto it.

Decide on roles

This is the moment when you decide the roles of the two people —we will give them names here so that it is easier to follow. The idea is that one person exclusively touches the clean material (i.e. not contaminated by hair, eyelashes, saliva, blood, sweat, whatever) and that the other person takes care of the rest. These roles can't be switched in the middle of the cleaning process (unless you restart from the beginning), so you choose them and stick to them. So, for example, the person who takes care of the clean material we will call **Casey** (there is a **C for Clean**). The other person who takes care of the contaminated material we will call **Danny** (there is an **D for Dirty**)[35].

The two people can get dressed together. If possible, get dressed away from the place where the work surface will be. Vigorously shake the clothes before putting them on (to get rid of potential hairs, or pieces of skin which could remain on them, and so won't be brought with you to where you are going to work). Put on the clothes, put on the hat, the hairnet, the mask or the hood that you have chosen. **Put on the gloves last.**

[33] *N.T.P. note:* In addition to preventing hair from falling, goggles can protect your eyes from bleach fumes. These fumes affect mucous membranes, including your eyes, especially in confined spaces with poor ventilation.

[34] Otherwise, to avoid dropping eyelashes and eyebrows, it's good to have a high enough work surface such that you are not bent over it.

[35] *N.T.P. note:* This zine doesn't discuss it, but the clean/dirty (Casey/Danny) roles should also be used during an action. For example, let's say you plan to use an incendiary device during an action. Casey only touches the incendiary device and any surfaces at the action site that need to be handled (e.g., a door handle, the cover of a fiber optic manhole). Danny touches anything that was brought to the action site and is therefore more likely to be contaminated with DNA: a backpack, the handles of the bolt cutter, the device packaging, etc. This division is just as important as when preparing for the action, and for the same reasons—if you contaminate the device with DNA when you place it, all the precautions you took when preparing for the action are irrelevant.

Small point on acetone: Acetone is a product that dissolves grease. It is therefore useful **to erase fingerprints[24], but not DNA traces**.

To clean an object of fingerprints that may have been deposited on it, we want to degrease its surface. To do this, you can use a sponge soaked in a little acetone and scrub, scrub, scrub. No need to put too big a dose, it is very volatile. Be careful not to inhale too much or swallow it, nor to spread it on your skin. It is toxic and not very good for your body.

On metal surfaces it is more complicated. Oxidation on metal (for example, rusty iron) will have the shape of fingertip patterns, so you will have to sand the surface that needs to be cleaned with sandpaper.

Bleach versus DNA: Clash of the Titans

Another thing that often comes up is that bleach can destroy DNA.

Destruction of genetic information by bleach

The active molecule* in bleach is sodium hypochlorite (NaClO). According to a 1971 study[16], it reacts with all DNA bases via oxidation reactions (chlorination, in this case). An article from 2004[17] quotes this study and states "Exposure of DNA to increasingly higher concentrations of sodium hypochlorite causes cleavage of the strands, breaking the DNA into smaller and smaller pieces, and eventually to individual bases." In other words, **bleach cuts DNA into small pieces**. The more concentrated it is and the longer it works, the smaller the pieces will be. This is exactly what we were talking about in relation to the stability of DNA.

[24] And even then, not on metal. For example where the grease that we naturally have on our fingers deposits, it protects the metal from corrosion, which leaves a negative trace that can be detected even in extreme conditions (on a bullet that has been fired, for example).

If the pieces of DNA, after the action of the sodium hypochlorite, are smaller than the STRs that the cops look for in their samples, then the identification process will be impossible.

The article[17] focuses on determining the effectiveness of bleach in decontaminating bones from the DNA of the archaeologists who collected them. Its conclusion is that immersing an object for about 10 minutes in bleach with 3% sodium hypochlorite cleanses it of DNA contamination[25].

Concentration of bleach

There are several ways to get an idea of the concentration of the bleach solution. The most commonly used for commercially available bleach products is the "percentage of active chlorine" (noted as % AC). For a fairly basic and concentrated solution, this "percentage of active chlorine" corresponds approximately to the concentration of sodium hypochlorite, i.e. the concentration of interest[20].

The concentration of sodium hypochlorite in the bleach that you will use therefore plays an important role. In stores, the most concentrated solutions are called "bleach extract", followed by "bleach berlingots", then "bleach water" and then "Labarraque water"[26].

[25] *N.T.P. note:* Other studies have found that the effectiveness of sodium hypochlorite in destroying DNA on a surface can vary depending on the type of surface, the type of sample (e.g. saliva, skin sample, blood) and the amount of DNA present. For example, one study found that 1% sodium hypochlorite did not sufficiently destroy DNA present on pitted plastic[18], while another found that 6% sodium hypochlorite did not sufficiently destroy the DNA in blood[19]. The article cited in the zine found that a 15-minute immersion in 3% sodium hypochlorite will "confidently destroy contamination", and yet they conclude that "we now regularly immerse both bones and teeth in 6.0% sodium hypochlorite for 15 min." The bottom line is that the exact concentration of sodium hypochlorite needed and its effectiveness are never certain. Therefore, the use of bleach to destroy DNA should be considered a partial measure: as much as possible, try to avoid leaving DNA traces in the first place.

[26] *N.T.P. note:* These terms are direct translations of bleach products available in France. If you're not in France, look for bleach products used for disinfecting (rather than for cleaning clothes). The concentration of sodium hypochlorite should be listed on the label or in a "safety data sheet" for the product, which can be found online.

2. Obtain equipment, get dressed

Equipment

For this step you will need the following equipment:

- Clothes that cover the whole body. You want long sleeves that are ideally tight at the wrists, as well as at the neck so as to not let your hair/skin fall onto the work surface. Clothes must be clean if possible, and should not let fibers fall (avoid fluffy wool, for example). Gloves can be taped to the wrists for longer sessions[30]. Otherwise, you can try full body paint suits or windbreakers[31].
- A clean hairnet or shower cap for a confident look (or cap, or windbreaker hood) that covers the head and prevents hair from getting onto the work surface. Clean, single-use hairnets can be a good approach.
- A mask, balaclava, something that covers the mouth, to avoid leaving saliva on the work surface (spit, breath…). Single-use hospital masks may work well[32]. Goggles or chemical masks can catch falling hairs[33], but are uncomfortable[34]. Washing your face beforehand means there will be less dead skin and hair that risk falling off, but this may be nitpicking.
- Thick dish-washing gloves, that go up well above the wrists, so as not to leave any DNA or fingerprints. Note: acetone attacks thin latex gloves, so avoid them. Also, thin gloves can be pierced more easily.

[30] *N.T.P. note:* You should use dishwashing gloves because they extend beyond the wrist to the middle of the forearm, making it less likely that your arm skin and hair will be exposed. You can also make a hole in each sleeve and place your thumbs inside before putting the gloves on. This will prevent the sleeves from sliding past the gloves.

[31] *N.T.P. note:* It's better to use a new full-body suit marketed for mold and asbestos removal, such as a Dupont Tyvek suit, because such suits are non-permeable. These are also used by police forensic teams to prevent DNA contamination.

[32] *N.T.P. note:* The face mask you use should filter aerosolized saliva. This is the case for N95 masks (U.S. rating) and FFP2 masks (European rating). In contrast, a surgical mask does not filter aerosolized particles.

1. Find a suitable location

Arrange to find a quiet spot where you are sure to not be disturbed by people who are not involved in the action or the cleaning and where you believe you won't be overheard. The more people pass by, the more it increases the risks of contamination (you don't want the people who pass by to leave their eyelashes on your things) and the more it increases your stress (and therefore your risk of error).

You should not be too pressed for time (a cleaning session can last 30 minutes or 2 hours, it would be a shame to be interrupted in the middle of work). It's good for the location to be somewhere you haven't been before (to prevent your DNA from already being present), to be clean (dust is full of dead cells and it can make you sneeze, which is not helpful at all) and tidy.

The work surface should be at a convenient height to avoid uncomfortable positions (bent back, bent neck). Also, having your head positioned above the work surface really increases the risk of contamination.

The space should not be too ventilated to avoid air movements which can dirty the work surface[29].

Once you have your location, the two of you get together, set out your equipment, and get to work.

[28] *N.T.P. note:* We do not recommend trying to remove fingerprints. Therefore, acetone and sandpaper are not necessary. See footnote 41, p. 41.

[29] *N.T.P. note:* From a ventilation standpoint, an indoor location is ideal, but it can be difficult to find an indoor location that you've never been to before and that provides the required privacy.

Another option is an outdoor location that gives you enough privacy (e.g., a very secluded area in the woods) where it isn't windy (e.g., because natural obstacles block the wind).

A final option is an outdoor location that gives you enough privacy where you bring a newly purchased large tent and work inside the tent, after getting dressed outside of it. A tent has the added advantage that you won't look suspicious to passersby when you're inside, though it should still be set up in a secluded area. Depending on your context, you may be able to buy a tent and return it to the store after using it to get your money back.

How to dilute bleach?

You may want to soak the items to be decontaminated in a bleach bath. This is the technique used in this article[17]: soak the items to be cleaned in a 3% sodium hypochlorite bleach bath for 10 minutes. To prepare a 3% sodium hypochlorite bleach bath, you can obtain 9.6% sodium hypochlorite bleach extract (at the hardware store, for example) and dilute it. Since I want a less concentrated solution, I just need to add the right amount of water. The volume of water to add is given by the following formula:

$$V_{\text{add}} = V_{\text{initial}}\left(\frac{C_{\text{initial}}}{C_{\text{final}}} - 1\right)$$

where, V_{initial} is the volume of bleach extract, C_{initial} is the concentration of sodium hypochlorite in the bleach extract and C_{final} is the concentration I want to obtain (3% sodium hypochlorite in our example). In this case it gives :

$$V_{\text{add}} = 2\left(\frac{9.6}{3} - 1\right) = 4.4\text{L}$$

Conclusion: if I add 4.4 L of tap water with 2 L of bleach extract, I get 6.4 L of bleach at 3% sodium hypochlorite for a good decontaminating bath.

A reminder of the precautions to take with bleach

First of all, bleach discolors, so there is a risk of stains on your clothes. Like any chemical product, the more concentrated the bleach is, the more it needs to be handled with care. It is used mixed with cold water. Using a mop with a little bleach in the water with bare hands already has a weird effect, but you won't end up in the hospital. As for the bleach extract, you have to be careful not to put it on your skin, and even more so to avoid getting it in your eyes. If this happens, rinse with a lot of water. Bleach also releases chlorine (a gas that's toxic for our lungs), and breathing too much of it can cause irritation. If this occurs, go outside and get some fresh air. Bleach reacts chemically with certain household products (those containing ammonia, phosphoric acid, hydrochloric acid). These reactions produce irritating, corrosive gases or liquids, so avoid this.

Burn the DNA, burn everything

If you use an incendiary device that works, any DNA will be destroyed by the fire, on the device itself and wherever the fire spreads[27]. That said, if the device does not work, traces can be found on it by the cops, hence the importance of leaving no DNA traces on the device.

Let's quickly return to cigarette butts being left in custody or elsewhere. A good blast from the lighter on the part of the cigarette your mouth has touched can make this butt useless to the forensic cops.

In the same way, one could clean an object (made of metal for example) with a small blowtorch that works with camping gas. Passing the blue cone of the flame of the blowtorch over the whole object allows the flame to burn the deposits of cells which contain the DNA.

Preventing the use of DNA by cops by targeting their specific practices

DNA analysis by cops involves chemical reactions: it is thus possible to disrupt them, especially using substances that inhibit the PCR process. For example, denim dyes, or certain substances in stamps[1] interfere with PCR. But, as a general rule, cops purify the DNA before analysis, so this is unreliable.

Another strategy is to interfere with the collection of DNA. In this regard, we have read stories about emptying a powdered fire extinguisher into a stolen car, to make collection more difficult, if not impossible.

[27] *N.T.P. note:* However, explosive devices do not necessarily destroy DNA, because their explosion is not a sustained source of heat. A study found that complete DNA profiles were obtained from samples taken from the debris of detonated explosive devices that used 7g of C-4 as their explosive charge[21].

A protocol for two

Here we propose a protocol for cleaning off the various traces that could be found by forensics and used to establish links between individuals, material and/or actions. In principle, there is nothing to prevent you from working alone, but we find that a group of two people is more efficient. One person can take care of the decontaminated material and the other of the contaminated material. If there are two of us, we can talk to each other during the procedure to share our doubts, questions, etc.

If there are more than two people, there is a greater risk of messing up and leaving more traces than we remove.

To better visualize the protocol, we can divide it into several successive steps:

1. Find a suitable location.
2. Obtain equipment, get dressed.
3. Prepare a surface, a work area.
4. Clean the material you want to clean.
5. Package the material for storage or transport.
6. Pack up the work area, put away what has been used.

It is possible to leave traces at each step of this protocol, so you need to be vigilant throughout the process.

General equipment list:

- Individually packaged thick dish-washing gloves (acetone attacks thin latex gloves)
- New garbage or freezer bags
- Appropriate clothing (see “Obtain equipment, get dressed”, p. 36)
- Bleach, acetone[28]
- New sponges in their packaging, sandpaper[28]
- Material to be cleaned