Opinion concerning the dissemination of DNA analysis identification techniques (genetic fingerprinting).

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Opinion

The huge diversity of man's genetic systems makes it possible to determine an individual's genetic traits and thus solve certain problems connected with identity, and consequently, to know whether or not two persons are related.

Blood traits have been known and used for many years, but now, recent advances in molecular genetics make it possible to determine new polymorphic traits of the DNA (deoxyribonucleic acid) that carries the genes. These are highly discriminating traits that can be evidenced by the examination of different types of matter removed from the body : fresh or dried blood, semen, hair, and various other tissues. A number of companies have filed applications for patents on the DNA analysis identification techniques known as genetic fingerprinting.

Genetic fingerprinting is a technique that is remarkable from the point of view of its underlying principle and in terms of its performance; combined with the technique of gene amplification, its potential scope for use is enormous.

However :

- this technique should not be allowed to replace former methods when these are applicable;
- it can present difficulties in the interpretation of results;
- gene amplification techniques (PCR) require the utmost rigour in order to avoid any risk of error.

Whilst recognising the value of such techniques, CCNE considers that their use should be strictly limited, given that they are a recent discovery and that difficulties exist regarding their application in judicial matters.

It is all the more vital to guarantee the quality of such tests in that, unlike with conventional expert opinion, laboratories might have a vested interest in promoting their own genetic identification techniques because of the operating monopoly that they enjoy through their patents. Moreover, a commercial monopoly could make it difficult to consult a second opinion.

The use of genetic testing must be strictly limited because of the principle involved. If it were accepted that they would be freely available whenever there existed a vested interest in genetically identifying someone, then the (official) civil identity of individuals would become a tradable commodity, replacing official state records, or could be used as a means of coercion upon a person - an especially dangerous means since biological identity or the consequences of knowing it are beyond the realm of free will.

These consequences conflict with social and ethical values that have, either implicitly or expressly, been enshrined in the fundamental principles of the laws and rights pertaining to individuals.

For example, in matters of civil and family law, in the absence of any record of civil identity or parentage - the establishment of which, apart from in a court case, does not require any biological proof - the overriding need to protect the child in a secure and stable family environment is sufficient justification for deciding that biological evidence may only be presented when deemed admissible and so authorised by a magistrate in the course of legal action on a matter of parentage.

Similarly, if used in other areas of everyday life, genetic fingerprinting techniques could endanger or undermine the system of official identity registers, the confidentiality of private life, the principle of non-discrimination because of race or parentage, or the freedom to work.

In criminal cases, the usefulness of genetic fingerprinting must be weighed against the difficulty of identifying beyond any doubt the initial sample taken, or of interpreting results. It does also potentially endanger some public freedoms and rights of the defence.

Consequently CCNE recommends :

1) that DNA analysis identification techniques be restricted to a small number of laboratories that have been specially authorised on the strength of their expertise and are recognised as qualified after undergoing quality inspections.

2) that the tests may only be performed when so ordered by a court decision

3) that only authorised laboratories may be called to give expert opinion in a court case.

CCNE is concerned with the need to protect public freedoms, and in order to avoid any kind of discrimination, and therefore draws attention to the dangers involved in conserving the results of DNA analysis identification tests.

Genetic identification techniques

Genetic traits do provide some answers to questions of identity.

- To whom does a human sample (blood, tissue, semen, hair) belong?

Application of these techniques in criminal cases can lead to the identification of a victim, or an assailant (or conversely to the ruling out of an individual).

- Are two individuals related? In civil matters, paternity suits or disputes, inheritance cases; in administrative matters, police control of immigration of family members.
- In addition, genetic traits could be used to determine vulnerability to certain illnesses or toxic substances.

The genetic traits that make this identification possible are polymorphic traits that exist in the population at large in at least two different forms (the rarer of the two being found in roughly one per cent of the population).

These traits have been known for a long time, the most thoroughly studied being those present in the blood (initially because of easy sampling) that are found:

- either in blood cells: erythrocytic blood groups, histocompatibility antigens (HLA),

- or in plasma : protein or enzyme polymorphism.

These traits are passed on according to the laws of heredity (Mendelian traits), those of the most practical use being the dominant ones since they are always expressed.

The physiological role of some of these traits is in many cases unknown (e.g. blood groups); where their role is known, there is often no difference in their physiological properties as a function of their different polymorphisms.

In some instances however, polymorphisms are associated with pathological syndromes - HLA antigens are one example.

More recently, evidence has been brought of polymorphism in DNA (deoxyribonucleic acid, the carrier of hereditary traits).

These are essentially hypervariable DNA sequences with a variable number of small repetitive sequences (cf. work by Jeffreys) that thus change the length of the DNA sequence according to the number of sequences. These sequences are passed on as Mendelian traits.

By using molecular probes (oligonucleotids), it is possible in a single test to detect these variations which are spread over several loci, producing restriction finger-prints that give a profile similar in appearance to the bar-codes used in the retail trade (hence the name genetic finger-printing).

Other polymorphisms could be used: polymorphic sequences that exist only once in the genome, such as VNTR (Variable Number of Tandem Repeat); these are variable segments of mitochondrial DNA passed on by the mother without recombination.

The scope for use of these techniques has increased thanks to a method of DNA amplification known as PCR (for Polymerase Chain Reaction) whereby it is possible to obtain from a minute quantity of DNA (a few cells, sometimes even a single cell) a very large amount of the area that is usable for the study of polymorphisms.

This amplification technique is very powerful, perhaps even excessively so, since every DNA segment corresponding to the area to be studied will be amplified, whether it comes from the original sample or is the result of soiling or contamination, and likewise, any manipulation error could produce an undetectable wrong diagnosis. Errors of this kind have already been reported, and users and manufacturers of the equipment and reagents are beginning to issue warnings and recommend the most stringent handling conditions possible as well as caution in interpreting the results.

In order to avoid these errors it would be absolutely necessary to perform such tests on different samples of the same "material", with each sample taking a totally independent route through the various technical steps and under conditions that avoid all sources of contamination.

The polymorphisms shown to be present on DNA do not provide any greater wealth of information than those already used, such as HLA. However, DNA is present in all nucleated cells of an organism, so it can be extracted from blood, semen, hair roots and by using amplification techniques the polymorphic segment can obtained from partially deteriorated DNA, which is why it is possible to identify from dried blood, for example.

As with the methods that have been used in the past, genetic fingerprinting is better at ruling out an identity or parental tie than at stating that two samples are identical; the problems are interpreting the comparison of the position of the bands, and also knowing the frequency of band profile distribution in the population at large, and in particular, in certain ethnic groups.

Several companies have already taken out patents covering these diagnostic methods.