

EasyDNA: user-friendly paternity and kinship testing programs

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Abstract. EasyDNA is a family of four computer programs developed for handling paternity and kinship determinations, and statistical calculations for (a) alleged fathers, (b) alleged fathers but without DNA typing, (c) incest cases, and (d) missing persons. These programs have been named EasyPA, EasyPant, EasyIN, and EasyMISS, respectively. The programs have wide applicability, and users can save results for checking and/or reporting purposes. The programs employ the distinctive pull-down manual, making them very user-friendly. In this paper, we are going to demonstrate the programs using a missing person example. © 2003 Elsevier B.V. All rights reserved.

Keywords: DNA profiling; Paternity; Kinship determination; Missing person

1. A case of missing person

EasyDNA consists of four different computer programs [1]. Here we demonstrate one of them, EasyMISS, using a missing person example. Consider a case that a person (X) goes missing and his family members report his disappearance to the local police force [2]. A dead body is found later, and the police likes to establish if the dead man is X using genetic testing. The DNA profiles of X's mother, two children, and three siblings are typed. The spouse (S) of X is not available, and instead her father and two siblings are typed. A total of 10 persons are typed. The hypotheses of interest are H_0 : the dead man (alleged X) was X, and H_1 : the dead man is not X. Although the problem looks complex, EasyMISS can handle it easily.

Scheme 1 gives the DNA profiles at locus D3S1358. For brevity, only one locus is considered though the program can handle any number of loci. The genotypes are inputted easily using the built-in pull-down manual. After clicking the box Calculate, the likelihood ratio is obtained immediately as 18.06. If we click the box Generate Output, the summary

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The screenshot shows a software window titled "Calculate likelihood ratio for missing person". It features a pedigree diagram with the following structure:

- Family 1:** Father of X (dropdowns) and Mother of X (14, 17) are parents of Sibling of X (14, 16), Sibling of X (14, 15), Sibling of X (14, 16), Sibling of X (dropdowns), and Sibling of X (dropdowns). Individual X is a "Missing Person".
- Family 2:** Father of S (14, 15) and Mother of S (dropdowns) are parents of S (Spouse of X) (dropdowns), Sibling of S (15, 16), Sibling of S (15, 18), and Sibling of S (dropdowns).
- Family 3:** Individual C (14, 15) and Sibling of C (15, 16) are parents of Sibling of C (dropdowns) and Sibling of C (dropdowns).

The LOCUS is set to "D3S1358". At the bottom, the "Alleged X" is (14, 15). The "Likelihood Ratio" is 18.063889. The "Prior Probability of Paternity" is 0.2. The output box shows "D3S1358 : 18.063889" and "Overall : 18.063889". Buttons include "Calculate", "Reset", "Exit", "<----- Remove", "Accumulate ----->", and "Generate Output".

Scheme 1. A missing person case example.

results will be saved in a file and they are shown in Table 1. This is very useful for checking and reporting purposes.

2. Concluding remarks

The developed software EasyDNA employs the distinctive pull-down manual, which makes the programs easy to use. The relationships of the people involved can be easily visualized using the provided pedigree diagram. We can also save the output for clients, for easy checking, and/or for legal purposes. The programs can handle both civil and criminal paternity cases, and kinship determinations for disasters such as air-crashes. The developed programs have wide applicability, e.g. motherless paternity case, motherless case with relatives of the mother typed, different alternative hypotheses H_1 (e.g. the true father is a relative of the alleged father), paternity testing when the alleged father cannot be typed, alleged parents, various kinship determinations such as three or more alleged sibs, incest case, and inheritance dispute case.

Besides giving the common likelihood ratios, the programs can also provide the posterior probabilities of paternity if required (see Table 1 of the missing person example). They can also allow for one or two mismatches of DNA profiles due to mutation. The residual and overall paternity indices are provided.

Table 1
Results output for the missing person case

Genotype information for locus: D3S1358	
Tested person	Genotype
Mother of X	(14, 17)
Sibling 1 of X	(14, 16)
Sibling 2 of X	(14, 15)
Sibling 3 of X	(14, 16)
Father of Spouse of X	(14, 15)
Sibling 1 of Spouse of X	(15, 16)
Sibling 2 of Spouse of X	(15, 18)
Child of X	(14, 15)
Sibling 1 of Child of X	(15, 16)
Alleged X	(14, 15)
Likelihood ratio = 18.063889	
Paternity probability	
Prior	Posterior
0.100	0.667454
0.200	0.818708
0.500	0.947545
0.900	0.993887

Interested readers can refer to Fung [1] for details of EasyDNA, for literature on paternity, and for discussion of paternity software.

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