EVALUATING THE EFFECT OF GLOBALFILER™ ON THE STRENGTH OF FAMILIAL SEARCHING IN A DATABASE

BRITISH COLUMBIA INSTITUTE OF TECHNOLOGY

FORENSIC SCIENCE & TECHNOLOGY

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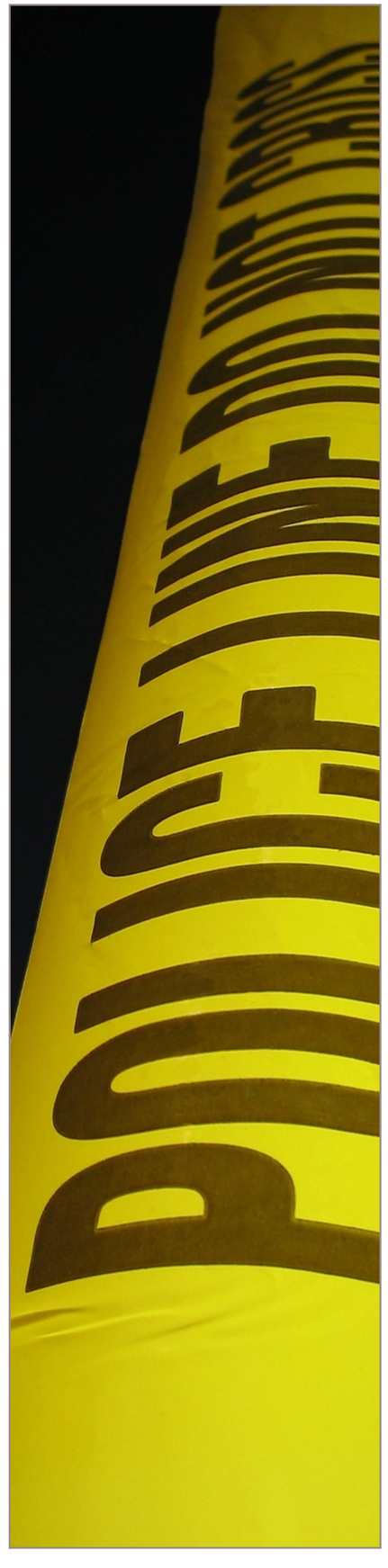
RITA GAREB



Abstract

The GlobalFiler™ Kit was shown to be a more efficient technology than the Identifiler™ Kit at producing DNA profiles for familial searching. The profiles of 25 questioned samples were derived using the 21 GlobalFiler™ autosomal loci and compared to the 15 Identifiler™ loci. Random Match Probabilities (RMP) and Kinship Likelihood Ratios (LR) were calculated for both sets of loci. GlobalFiler™ demonstrated a stronger RMP and LR than did Identifiler™. GlobalFiler™ also provided more allelic information than did Identifiler™ exhibiting a greater overall success rate.

Introduction

Familial searching involves looking for partial matches in a database between an unknown DNA profile and a known DNA profile with the hopes of uncovering a relative of the unknown source when a direct match is not possible. Familial searching is dependent on both the size of the database and the number of loci used in determining the DNA profiles. Currently there are 13 core CODIS loci used in DNA profiling that make up all the profiles in our national DNA database. Life Technologies Corporation has created and marketed a profiling technique that almost doubles the profiling markers to 21 autosomal STR loci with a technology called GlobalFiler™. The FBI has since given official approval for the use of GlobalFiler™ by the National Index System for the generation of DNA profiles for inclusion in the CODIS database. This development expedites the need to investigate the effect of additional loci on familial searching in a database.

Procedures

25 question samples were provided by the BC Coroners Services for analysis. 21 of the 25 questioned samples were already extracted and preserved in TE buffer, the remaining 4 were bone samples. Standard extraction methods were carried out on the bone samples. An internal blood standard was prepared as a positive control and a Lysis buffer/Proteinase K solution was used as a negative control. Quantifiler was used to determine DNA concentrations for the 4 bone extractions. All extracted samples were prepared for amplification.

The amplified products were evaluated using the Genetic Analyzer 3500 manufactured by Life Technologies along with a Positive Control (007 DNA Standard), a Negative Control (low TE buffer), and the GlobalFiler™ Allelic Ladder for comparative purposes. The profiles resulting from this analysis were GlobalFiler profiles. Identifiler profiles were derived by isolating the 15 Identifiler autosomal loci and deleting the following unique GlobalFiler loci: D10S1248, D12S391, D1S1656, D22S1045, D2S441, and SE33.

Results

Table 1 - Profile Success Rate

			Success Rates	Success Rates
Q-Sample	Identifiler	GlobalFiler	Identifiler	GlobalFiler
Q-22	15	21	100%	100%
Q-24	15	21	100%	100%
Q-15	15	21	100%	100%
Q-2	1	3	7%	14%
Q-3	5	19	33%	90%
Q-4	15	20	100%	95%
Q-5	15	21	100%	100%
Q-6	1	2	7%	10%
Q-7	11	16	73%	76%
Q-8	2	3	13%	14%
Q-9	6	9	40%	43%
Q-11	15	21	100%	100%
Q-12	15	21	100%	100%
Q-13	11	16	73%	76%
Q-14	1	3	7%	14%
Q-20	15	21	100%	100%
Q-19	15	21	100%	100%
Q-16	15	21	100%	100%
Q-17	9	13	60%	62%
Q-18	15	21	100%	100%
Q-23	15	21	100%	100%
Q-25	15	21	100%	100%

Question Bone Sample

Table 2 - Random Match Probability (RMP)

	Identifiler	GlobalFiler
Sample	RMP	RMP
Q-22	4.76E+17	4.55E+30
Q-24	2.48E+19	1.89E+31
Q-15	1.05E+20	1.25E+31
Q-2	2.42E+03	7.34E+06
Q-3	4.13E+11	4.13E+11
Q-4	2.04E+19	1.71E+28
Q-5	1.97E+15	4.33E+25
Q-6	1.67E+02	8.25E+03
Q-7	8.14E+12	4.27E+23
Q-8	4.56E+03	4.56E+03
Q-9	3.61E+13	3.61E+13
Q-11	4.29E+17	4.78E+27
Q-12	1.56E+19	4.14E+31
Q-13	2.20E+12	2.26E+20
Q-14	5.54E+03	5.54E+03
Q-20	7.74E+16	2.70E+26
Q-19	1.49E+18	1.58E+28
Q-16	7.18E+19	1.87E+30
Q-17	3.07E+10	3.32E+16
Q-21	1.67E+09	7.49E+31
Q-18	7.43E+20	7.49E+31
Q-23	9.36E+17	7.73E+30
Q-25	6.79E+19	1.31E+30

Table 3 - Kinship Likelihood Ratios

		Identifiler	Identifiler	GlobalFiler	GlobalFiler
Q-Sample	K-Sample	LR-Sibling	LR-Parent	LR-Sibling	LR-Parent
Q-22	K-22		319.0237		3.44E+05
Q-24	K-24		7.86E+05		9.09E+09
Q-15	K-15		6509.593		1.68E+06
Q-2	K-2		31.25		142.2288
Q-3	K-3		2.9537		133.3907
Q-4	K-4		1.18E+06		1.98E+06
Q-5	K-5		72.7239		1.12E+04
Q-6	K-6		6.8587		8.6469
Q-7	K-7		681.0452		9.55E+04
Q-8	K-8		3.1587		5.4724
Q-9	K-9		43.4924		5049.687
Q-11	K-11		57.9845		5903.072
Q-12	K-12		2583.033		1.59E+06
Q-13	K-13		639.1787		1.09E+04
Q-14	K-14		1.4233		3.0464
Q-20	K-20		467.0897		8748.165
Q-20	K-20a	7147.457		4.59E+06	
Q-19	K-19		4478.507		3.27E+06
Q-16	K-16		4832.122		4.83E+05
Q-17	K-17		85.453		699.7317
Q-18	K-18		1.15E+04		2.54E+06
Q-23	K-23		3.79E+04		1.20E+09
Q-25	K-25		1.87E+04		1.48E+08
Q-25	K-25a	21.8927		1.25E+05	

Discussion

The success rates of the profiles range from 7-100% for Identifiler and 10-100% for GlobalFiler. As Table 1 outlines, the success rate of GlobalFiler exceeded that of Identifiler for each sample under 100%. Sample Q-4 exhibited a 100% success rate for Identifiler loci but 94% success rate for GlobalFiler. This is due to one of the new GlobalFiler loci not rendering results. Q-4 exhibited all the Identifiler loci as well as 5 of the 6 extra GlobalFiler loci and also exhibited a higher RMP and LR as shown by Tables 2 and 3 respectively.

For each of the questioned profiles that exhibited alleles, all the GlobalFiler profiles exhibited alleles at more loci than Identifiler with no exceptions. For each of the questioned samples that exhibited alleles, all of the GlobalFiler profiles exhibited higher Random Match Probabilities and stronger Likelihood Ratios than the Identifiler profiles, without exception. These results indicate that the extra alleles provide for a stronger outcome in regards to familial searching in a database

Conclusions

GlobalFiler™ will improve the strength of familial searching in a database. Even though familial searching is not used as an investigative tool in Canada in regards to the criminal justice system, there are still significant implications of this research. These implications pertain to the identification of deceased persons who currently remain unidentified nationwide, as well as any decedents that may need to be identified going forward. With this new technology amplifying the power of familial searching, GlobalFiler™ will increase the potential to lay to rest unidentified human remains.

References

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