

Updates to the Forensic Research/Reference on Genetics knowledge base (FROG-kb) database

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Abstract

This poster provides an overview of the capabilities and functionality of the Forensic Research/Reference on Genetics knowledge base (FROG-kb) as a resource to make allele frequency data for Single Nucleotide Polymorphisms (SNPs) and other genetic polymorphisms more useful in the forensic field. FROG-kb (http://frog.med.yale.edu/FrogKB) is an online database that provides tools for comparing user-provided data with underlying allele frequencies in populations, and it serves as a resource for teaching and research. Current SNP panels on FROG-kb include Individual Identification (IISNPs), Ancestry Inference (AISNPs), and Phenotype Interference (PISNPs). The data used in FROG-kb calculations derive from the ALIele FREquency Database, ALFRED (http://alfred.med.yale.edu), a continually updated database of allele frequency data on SNPs and other genetic polymorphisms.

SNPs can be valuable for investigative leads when known profiles using Short Tandem Repeats (STRs) are not available and no hits in such databases as the Combined DNA Index System (CODIS) are identified. The investigative leads provided by SNPs can include ancestry and phenotype interference, and individual identification, all of which are provided in the FROG-kb database. This poster will provide the forensic community with an overview of FROG-kb; recent updates to the database, including data and website enhancements; and a visual on how to utilize FROG-kb.

2. New Data Additions and FROG-kb Usage Summary

Curators of FROG-kb have added new SNP panels, reference populations, and expanded existing SNP panels. **Table 1** shows the new data additions to FROG-kb. Usage statistics of the database from May 2014 to May 2015 are shown in **Table 2**. The number of visitors are determined by the IP address, and a hit is considered a request for any file (e.g., page, image).

Table 1: New data additions to FROG-kb.

New AISNP Panel	Additional Reference Populations	Expansion of Daniele Podini's list of 32 AISNPs
• Overlap set of AISNPs	 Kayser's set of 24 Ancestry Informative Markers Daniele Podini's list of 32 AISNPs Nievergelt's set of 41 AIMs Kidd Lab set of 55 AISNPs Qiagen Investigator DIPplex[®] kit included 	 Included calculations of likelihood for four more SNPs, bringing the count to 29

Table 2: General statistics from FROG-kb May 2014 to May 2015.

Average hits p

Average visit

Total ur

1. Introduction

Recent updates to FROG-kb have centered on inputting additional data and website enhancements to provide an organized and easily navigated resource for the forensic community. One of the updates entailed creating a comprehensive user manual that provides users with step-by-step directions on how to use and search FROG-kb from the different SNP panels. This poster will provide an overview of the new infrastructure to utilize the database for forensic purposes, including a user manual to assist in the process, as well as discussion of the results of searches and what can be done with the data.

Total hits	37,821
sitor hits	37,821
er visitor	11.39
al visitors	3,322
s per day	9
nique IPs	939

3. FROG-kb Features

Some of the updated features to the FROG-kb website are shown in the database's Main Menu (**Figure 1**). The Main Menu allows easy navigation among menu options and is accessible from any page on the FROG-kb database.

Clicking the Documentation feature in the Main Menu opens an additional set of option buttons for users to learn more about FROG-kb capabilities. Below we list information that can be found in each Documentation option button.

- Functionalities: provides an overview for navigating through the SNP panel information, SNP panel example data, SNP panel data entry, and results of the data entry calculations.
- Pipeline: opens a graphical representation that illustrates the process for inputting, searching, and retrieving data from FROG-kb (shown below for IISNP [**Figure 2**] and PISNP [**Figure 3**]).
- **FAQ:** presents answers to Frequently Asked Questions about FROG-kb.
- Manual: provides details on navigating, data entry, and searching the database
- Resources: provides users with links (STR-and SNP-based) and references to potentially relevant databases and sites. This page also lists poster presentations pertaining to FROG-kb that have been presented at annual conferences and that are freely accessible to users.

Figure 1. FROG-kb website with the Main Menu options.

		frog.med.yale.edu	Ç	
FROG-kb	Forensic]	Resource eference	On Genetics	S knowledge base
Home IISNP AISNP	PISNP Docum	entation Contact	Us Announcements	
Welcome to the New	FROG-kb			
"space" for additional docu updates. New FROG-kb ca Internet Explorer are not c function to reach us. "If yo	an be best viewed o compatible. If you co u see something - s	be added over the i on latest Mozilla Fire me across any issu ay something"	next few weeks. See <u>Ar</u> efox and Google Chrom les or have suggestions	nouncements for e. Some versions of s use the <u>Contact Us</u>
FROG-kb seeks to make a forensic setting. The prima perspective, is useful for te underlying data are house (<u>ALFRED</u>). The FROG-kb tools for comparing user-p organized by the methodo	allele frequency data ary objective of FRO eaching and research d in the already extend interface makes the provided data with un logy followed and the	a for SNPs and othe G-kb is to provide a ch and can serve as ensively used and r information usable nderlying allele freq ne different publishe	er genetic polymorphism a web interface that, fro s a tool facilitating foren referenced ALIele FREq e for forensic purposes, juencies in populations. ed SNP/marker panels a	ns more useful in a m a forensic sic practice. The uency Database including computational These tools are available.
FROG-kb considers three and Phenotype Inference individual at multiple SNPs The current PISNP panel i colors. More information o information on searching e	types of SNP panel (PISNPs). IISNP and s and calculate prob is an eye color predi in each SNP panel of each SNP panel with	s: Individual Identified d AISNP panels pro- pabilities of that mul- iction function that p can be found in Sec- nin FROG-kb.	ication (IISNPs), Ancest ovide the ability to enter tisite genotype in each provides relative probat ction 4.1 of the <u>User Ma</u>	try Inference (AISNPs), genotypes of an of several populations. pilities of different eye nual along with

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4. IISNP Data Entry and Data Output

IISNPs provide the ability to calculate random match probabilities for user-specified genotypes. Figure 2 provides an overview of data entry and data computation for the KiddLab – 45 Unlinked IISNPs. AISNPs provide the ability to calculate relative likelihoods of ancestry from different reference populations for user-specified genotypes. The functionalities shown in **Figure 2** for IISNPs are the same for AISNP data entry and data computation.

Figure 2: Overview of IISNP data entry and data output.



5. PISNP Data Entry and Data Output

PISNPs provide the ability to predict a visible trait for user-specified genotypes for the relevant SNPs. **Figure 3** provides an overview of data entry and data computation for the Kayser's 6-plex for eye color prediction – IrisPlex. The data shows the eye color predicted probability for a Hungarian population.

Figure 3: Overview of PISNP data entry and data output.



6. Conclusion

Understanding and utilizing SNPs are important as a new area in the forensic field, and FROG-kb serves to provide this to the community in a user-friendly, free, and web-accessible resource. Curators of FROG-kb and the Forensic Technology Center of Excellence (FTCoE) have worked together to increase awareness of FROG-kb, enhance website functionalities, and develop a user's manual for step-by-step guidance for accessing, navigating, and searching FROG-kb.

7. References

- Rajeevan H, Soundararajan U, Pakstis AJ, Kidd KK. Introducing the Forensic Research/Reference on Genetics knowledge base, FROG-kb. Investigative Genetics. 3(18):1-8. (2012).
- Rajeevan H, Soundararajan U, Kidd JR, Pakstis AJ, Kidd KK. ALFRED: an allele frequency resource for research and teaching. Nucleic Acids Res. 40:D1010– D1015. (2012).

Acknowledgments

- This work is supported in part by grant 2014-DN-BX-K030 awarded by the National Institute of Justice, Office of Justice Programs, U.S. Department of Justice and also in part by National Science Foundation grant BCS-1444279.
- RTI International assisted in the development of the new interface by providing feedback and documentation, including a user's manual and pipeline, and by promoting and familiarizing the forensic community with the FROG-kb database through the FTCoE. RTI was awarded the FTCoE (NIJ award 2011-DN-BX-K564) to provide knowledge transfer and technology adoption to the criminal justice and forensic science communities.
- Points of view in this document are those of the authors and do not necessarily represent the official position or policies of the U.S. Department of Justice.

More Information

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Presented at: the American Academy of Forensic Sciences (AAFS) 68th Annual Scientific Meeting, Las Vegas, NV, February 22-27, 2016

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