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 ALlele 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.

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.

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.

Total hits	37,821
Visitor hits	37,821
Average hits per visitor	11.39
Total visitors	3,322
Average visitors per day	9
Total unique 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.

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.

* The diagram shown is only an example for IISNP data entry, although you will find the same functionalities for AISNP data entry. More information on IISNP and AISNP can be found in the User's Manual.

5. PISNP Data Entry and Data Output

PISNPs provide the ability to predict a visible trait for user-specified genotypes 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.

Eye Color	Predicted Probability
Blue	0.2072
Interm	0.1611
Brown	0.6317

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

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