



Letter to the Editor

Selection and implementation of expanded CODIS core loci in the United States


Dear Editor,

This letter is to update the DNA community on the Federal Bureau of Investigation (FBI) CODIS Core Loci Working Group's progress and the evaluation of additional core loci. As announced in previous communications initially published online in April of 2011 [1,2], the FBI launched this effort to determine additional core loci that could be implemented into the CODIS Program to support law enforcement DNA databases. The goals of this expansion include reducing the number of adventitious matches, increasing international compatibility and increasing the power of discrimination for criminal and missing person cases. The current CODIS core 13 loci were given primary consideration, with one exception, for inclusion within the proposed core set of loci for CODIS. In addition, other loci that are currently part of DNA typing kits used in the United States were considered as potential new loci [3]. Loci used internationally for forensic DNA databasing purposes were also identified for consideration [4]. It is important to note that the loci chosen for this project have no known predictive value for medical condition or disease. The Working Group developed and published an implementation timeline for the public in June 2011 [5].

As noted in the initial explanation of this Project, a ranked list of loci were recommended (Table 1). In the fall of 2012, manufacturer grade PCR amplification kits containing those loci became available for use in the United States. The CODIS Core Loci Working Group selected a consortium of 11 CODIS laboratories representing casework, databasing and missing person laboratories to evaluate the available PCR amplification kits: Life Technologies' GlobalFiler[®], Life Technologies GlobalFiler[®] Express and Promega Powerplex[®] Fusion. Over an eighteen month period, these laboratories performed validation experiments in accordance with the FBI Director's Quality Assurance Standards that included studies on the following: known or non-probative samples, precision, reproducibility, sensitivity and stochastic, mixture, and casework challenge samples. With the assistance of the National Institute of Standards and Technology (NIST), the data generated through these validation studies were compiled, reviewed and analyzed. During this Project, the FBI has provided updates to the DNA community and stakeholders through presentations at annual National CODIS Conferences, semiannual CODIS State Administrators meetings, semiannual meetings of the Scientific Working Group on DNA Analysis Methods (SWGAM), as well as the annual International Symposium on Human Identification.

Consistent with the initial considerations in the selection of the proposed core loci, the Working Group acknowledged that there are almost 14 million STR profiles in the National DNA Index

System that contain the current 13 CODIS Core Loci, thus compelling the continued use of these loci in the core loci set. Review of the validation data did not result in exclusion of any of the proposed additional core loci. Based upon the validation data, it was determined that the 20 loci that were in common between the two available PCR amplification kits would be selected as the new 20 CODIS Core Loci (Table 2). Thus, the original 13 CODIS Core Loci and the following seven new loci will comprise the new 20 CODIS Core Loci: D1S1656, D2S441, D2S1338, D10S1248, D12S391, D19S433 and D22S1045 (Table 2).

Data from the validation studies and the proposed 20 CODIS Core Loci were presented to SWGDAM at their July 2014 Meeting. There was consensus among the SWGDAM participants to proceed with the selection and implementation of the new 20 CODIS Core Loci.

After determination of the new 20 CODIS Core Loci, the Working Group also sought input from the DNA community on their

Table 1

Proposed Core Loci. (For interpretation of the references to colour in this Table legend, the reader is referred to the web version of this article.)

	Locus
Section A (required)	Amelogenin
	D18S51
	FGA
	D21S11
	D8S1179
	vWA
	D13S317
	D16S539
	D7S820
	TH01
	D3S1358
	D5S818
	CSF1PO
	D2S1338
	D19S433
	D1S1656
D12S391	
D2S441	
D10S1248	
DYS391	
Section B (in order of preference)	TPOX
	D22S1045
	SE33

Table 2

New 20 CODIS Core Loci. (For interpretation of the references to colour in this Table legend, the reader is referred to the web version of this article.)

Locus
CSF1PO
D3S1358
D5S818
D7S820
D8S1179
D13S317
D16S539
D18S51
D21S11
FGA
TH01
TPOX
vWA
D1S1656
D2S441
D2S1338
D10S1248
D12S391
D19S433
D22S1045

Red is for original CODIS Core 13 Loci.

Blue is for new additional CODIS Core Loci.

readiness for a potential implementation date of January 1, 2017. The FBI's CODIS Unit conducted an informal survey of CODIS laboratories for input on the community's readiness for implementation of the additional CODIS Core Loci. Approximately, 11% of the CODIS laboratories reported that they are currently using one of the three STR amplification kits (Life Technologies' GlobalFiler[®], Life Technologies GlobalFiler[®] Express and Promega Powerplex[®] Fusion) for DNA analysis. Another 41% of CODIS laboratories are currently validating one of the three STR amplification kits. When surveyed on readiness for implementation, approximately 76% of the CODIS laboratories reported that they would need 18 months

or less to implement the additional CODIS Core Loci within their laboratories and a total of 95% of the CODIS laboratories reported that they would need 24 or less months to implement the new CODIS Core Loci. Based upon this input from the CODIS laboratories, the 24 month window for implementation is sufficient for the overwhelming majority of CODIS laboratories and thus the FBI intends to require implementation of the new 20 CODIS Core Loci by January 1, 2017. As required by the Justice for All Act [6], the FBI notified the U.S. Congress in December, 2014 of the new CODIS Core Loci and proposed implementation date.

The FBI will continue to update the DNA community and its stakeholders on the new 20 CODIS Core Loci at every opportunity. As CODIS laboratories prepare for implementation of the new additional loci into their forensic DNA laboratory operations, SWGDAM's CODIS Committee will now consider specific implementation issues on searching, matching and confirmation strategies for the new Core Loci.

References

- [1] D.R. Hares, Expanding the CODIS Core Loci in the United States, *Forensic Sci. Int. Genet.* 6 (2012) e52–e54.
- [2] D.R. Hares, Addendum to expanding the CODIS Core Loci in the United States, *Forensic Sci. Int. Genet.* 6 (2012) e135.
- [3] J.M. Butler, Genetics and genomics of core short tandem repeat loci used in human identity testing, *J. Forensic Sci.* 51 (2006) 253–265.
- [4] P.M. Schneider, Expansion of the European Standard Set of DNA Database Loci – the Current Situation, *Profiles in DNA*, Vol. 12, No. 1 (2009). Available at: http://www.promega.com/profiles/1201/1201_06.html.
- [5] <http://www.fbi.gov/about-us/lab/biometric-analysis/codis/planned-process-and-timeline-for-implementation-of-additional-codis-core-loci>.
- [6] <http://www.rainn.org/pdf-files-and-other-documents/Public-Policy/Key-Federal-Laws/PL108-405.pdf> Justice for All Act of 2004 (Public Law 108-405, section 203(f)); see

Douglas R. Hares*

FBI Laboratory, 2501 Investigation Parkway, Quantico, VA 22135, USA

* Tel.: +1 703 632 7576; fax: +1 703 632 8305.
E-mail address: Douglas.Hares@ic.fbi.gov (D. Hares).

Received 6 January 2015

Received in revised form 29 January 2015

Accepted 10 March 2015