OSAC RESEARCH NEEDS ASSESSMENT FORM

Title of research need:	The Role and Impact of Pharmacogenetics and Pharmacogenomics in Forensic Toxicology
Keyword(s):	Pharmacogenetics, Pharmacogenomics, Pharmacokinetics, Pharmacodynamics, Drug Interactions
Submitting subcommittee(s):	Toxicology
Date Approved:	4/2/18

(If SAC review identifies additional subcommittees, add them to the box above.)

Background Information:

1. Description of research need:

Research is needed to evaluate the role of pharmacogenetics and pharmacogenomics in the field of forensic toxicology. Pharmacogenetics investigates genetic differences in metabolic pathways which results in variation in individual responses to xenobiotics and effect(s) on the intended therapeutic efficacy and potential adverse events (e.g. overdose). Pharmacogenomics is the study of how individual genetic polymorphisms may affect the response to drug(s). Research in these areas may provide a greater understanding of the role of pharmacogenetics and pharmacogenomics in interpreting drug concentrations determined from ante- and post-mortem forensic toxicological analysis.

2. Key bibliographic references relating to this research need:

1. Nita A. Limdi, David L. Veenstra, Expectations, validity, and reality in pharmacogenetics, In Journal of Clinical Epidemiology, Volume 63, Issue 9, 2010, Pages 960-969, ISSN 0895-4356, https://doi.org/10.1016/j.jclinepi.2009.09.006.
2. A. Sajantila, J.U. Palo, I. Ojanperä, C. Davis, B. Budowle, Pharmacogenetics in medico-legal context, In Forensic Science International, Volume 203, Issues 1–3, 2010, Pages 44-52, ISSN 0379-0738, https://doi.org/10.1016/j.forsciint.2010.09.011.
3. Frank Musshoff, Ulrike M. Stamer, Burkhard Madea, Pharmacogenetics and forensic toxicology, In Forensic Science International, Volume 203, Issues 1–3, 2010, Pages 53-62, ISSN 0379-0738, https://doi.org/10.1016/j.forsciint.2010.07.011.
4. Victor E. Ortega, Deborah A. Meyers, Pharmacogenetics: Implications of race and ethnicity on defining genetic profiles for personalized medicine, In Journal of Allergy and Clinical Immunology, Volume 133, Issue 1, 2014, Pages 16-26, ISSN 0091-6749, https://doi.org/10.1016/j.jaci.2013.10.040.
5. Bhushan M. Kapur, Prateek K. Lala, Julie L.V. Shaw, Pharmacogenetics of chronic pain management, In Clinical Biochemistry, Volume 47, Issues 13–14, 2014, Pages 1169-1187, ISSN 0009-9120, https://doi.org/10.1016/j.clinbiochem.2014.05.065.
6. Jessica Lam, Karen L. Woodall, Patricia Solbeck, Colin J.D. Ross, Bruce C. Carleton, Michael R. Hayden, Gideon Koren, Parvaz Madadi, Codeine-related deaths: The role of pharmacogenetics and drug interactions, In Forensic Science International, Volume 239, 2014, Pages 50-56, ISSN 0379-0738, https://doi.org/10.1016/j.forsciint.2014.03.018.

7. Hicks, J., Bishop, J., Sangkuhl, K., Müller, D., Ji, Y., Leckband, S., Leeder, J., Graham, R., Chiulli, D., LLerena, A., Skaar, T., Scott, S., Stingl, J., Klein, T., Caudle, K. and Gaedigk, A. (2015), Clinical Pharmacogenetics Implementation Consortium (CPIC) Guideline for CYP2D6 and CYP2C19 Genotypes and Dosing of Selective Serotonin Reuptake Inhibitors. Clin. Pharmacol. Ther., 98: 127–134. doi:10.1002/cpt.147
8. Hicks, J., Sangkuhl, K., Swen, J., Ellingrod, V., Müller, D., Shimoda, K., Bishop, J., Kharasch, E., Skaar, T., Gaedigk, A., Dunnenberger, H., Klein, T., Caudle, K. and Stingl, J. (2017), Clinical pharmacogenetics implementation consortium guideline (CPIC) for CYP2D6 and CYP2C19 genotypes and dosing of tricyclic antidepressants: 2016 update. Clin. Pharmacol. Ther., 102: 37–44. doi:10.1002/cpt.597
9. Munir Pirmohamed, Pharmacogenetics for the prescriber, In Medicine, Volume 40, Issue 7, 2012, Pages 362-365, ISSN 1357-3039, https://doi.org/10.1016/j.mpmed.2012.04.005.
10. Bank, P.C., Swen, J.J., Guchelaar. Pharmacogenetic biomarkers for predicting drug response. Expert Review of Molecular Diagnostics. Volume 14, Issue 6, 2014, Pages 723-735 https://doi.org/10.1586/14737159.2014.923759

3a. In what ways would the research results improve current laboratory capabilities?

Forensic Toxicologists may be asked to provide interpretations on the significance of drug concentrations determined through laboratory analysis. It is widely known that inter-individual variations in drug adsorption, distribution, metabolism, and excretion exists. Specific to forensic toxicology is a lack of research regarding the roles of pharmacogenetics and pharmacogenomics in understanding these variations.

3b. In what ways would the research results improve understanding of the scientific basis for the subcommittee(s)?

Research in the areas of pharmacogenetics and pharmacogenomics, specific to forensic toxicology, will add to the body of knowledge on individual variability, may help to provide insight on the significance of variations, and improve interpretive capabilities of forensic toxicologists.

3c. In what ways would the research results improve services to the criminal justice system?

At times, forensic toxicologists are asked to provide scientific information to attorneys, judges, and jurors on the role drug(s) may have played in an individual's impairment or death. Data related to individual variations in pharmacodynamics/pharmacokinetic variations and the role pharmacogenetics/pharmacogenomics play in these differences is limited. If the body knowledge was expanded, forensic toxicologists would be able to provide more comprehensive interpretation to the criminal justice system as a whole.

4. Status assessment (I, II, III, or IV): II

	Major gap in current knowledge	Minor gap in current knowledge
No or limited current research is being conducted	I	III

Existing current research is being conducted	II	IV

This research need has been identified by one or more subcommittees of OSAC and is being provided as an informational resource to the community.

Approvals:

Subcommittee	Approval date: 4/2/18
(Approval is by majority vote of subcommittee. Once approved, forward to SAC.)	

SAC

1. Does the SAC agree with the research need? Yes [x] No [ ]
2. Does the SAC agree with the status assessment? Yes [x] No [ ]

If no, what is the status assessment of the SAC: [ ]

Approval date: 4/2/18

(Approval is by majority vote of SAC. Once approved, forward to NIST for posting.)