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**Rapidly mutating Y-chromosomal STRs**

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Y-chromosomal STRs (Y-STRs) currently applied in forensic analysis provide high but not maximal resolution in male lineage differentiation and their power to separate male relatives is low. Consequently, using current marker sets, conclusions from Y-STR analysis usually cannot be made on the individual level as anticipated in the forensic arena, which represents a major drawback. However, it would be desirable to combine the advantage of Y-chromosome analysis in separating male from female DNA components in mixed stain analysis, such as it is essential for solving cases of sexual assault, with the advantage of autosomal STR analysis in individual identification, which often is not informative in mixed stain analysis. In order to find rapidly mutating Y-STRs for differentiating male relatives, we previously performed a large mutation rate study analyzing 186 Y-STRs in ~2000 father-son pairs and identified a set of 13 markers that mutate considerably faster than all other loci tested. We recently showed that this set of rapidly mutating (RM) Y-STRs can differentiate male relatives in a large number of cases (i.e., 67% of relatives separated by 1-20 generations whereas Yfiler only did 15%). Furthermore, we showed that RM Y-STRs increase male lineage differentiation considerably (i.e., by 8% from 90.4% with Yfiler to 98.3% with RM Y-STRs in the worldwide HGDP-CEPH samples). To provide further prerequisites for forensic applications of RM Y-STRs, and to make the data finally available for haplotype search in future forensic case work, we now carried out a multicenter study involving 70 institutions from around the world. We collected quality-controlled data for the 13 previously identified RM Y-STRs from over 10,000 unrelated male individuals; for about 7000 of them conventional Y-STR data (Yfiler) are available to us for comparative analysis. Furthermore, we collected RM Y-STR data on >1000 father-son pairs for additional male relative differentiation testing. In this plenary talk I will summarize the benefits of using RM Y-STRs in forensic analyses and will provide the first results and conclusions from this multicenter study on behalf of the RM Y-STR Study Group<sup>a</sup>.

<sup>a</sup>RM Y-STR Study Group: Ballantyne K, Ralf A, Aboukhalid R, Achakzai NM, Anjos MJ, Ayub Q, Balazic J, Ballantyne J, Ballard DJ, Barbarii L, Berger B, Bobillo C, Bouabdellah M, Burri H, Butler J, Capal T, Caratti S, Carracedo A, Cartault F, Carvalho EF, Carvalho M, Cheng B, Coble MD, Comas D, Corach D, D'Amato ME, Davison S, de Knijff P, de Ungria M, Decorte R, Dixon R, Dobosz T, Dupuy BM, Elmrghni S, Gan LSH, Gliwinski M, Gomes SC, Grol L, Haas C, Hanson E, Henke J, Henke L, Hill CR, Holmlund G, Honda K, Immel U, Inokuchi S, Jobling MA, Kim JS, Kim SH, Kim W, King TE, Klausriegler E, Kling D, Kovacevic LL, Kovatsi L, Krajewski P, Kravchenko S, Kvitkova D, Larmuseau M, Lee EY, Lee SH, Lessig R, Livshits LA, Marjanovic DD, Minarik M, Mizuno N, Moreira H, Morling N, Mukherjee M, Nagaraju J, Neuhuber F, Nie S, Oh HH, Olofsson J, Onofri V, Palo J, Pamjav H, Parson W, Payet C, Petlach M, Phillips C, Ploski R, Prasad SPR, Primorac D, Purnomo GA, Purps J, Rangel H, Rebala K, Rerkamnuaychoke B, Robino C, Rodríguez F, Roewer L, Rosa A, Sajantila A, Sala A, Salvador J, Sanz P, Savov A, Schmitt C, Sharma AK, Shin KJ, Shotivaranon J, Sijen T, Silva DA, Sirker M, Siváková D, Skaro V, Solano-Matamoros C, Souto L, Stenzl V, Sudoyo H, Syndercombe-Court D, Tagliabracci A, Taylor D, Tillmar A, Tsybovsky IS, Tyler-Smith C, van der Gaag KJ, Vanek D, Völgyi A, Ward D, Willemse P, Winkler C, Yong RYY, Zaharova B, Zupanic Pajnic I, and Kayser M