Forensic science lecture 4 17 01 2013

Science, Genetics

Forensic Science lecture 4 — 17/01/2013 Quiz: quiz after every 2 weeks, done through bb, posted midnight Sunday 12, close midnight Monday at 12. Video watched through class, Guest speaker: Heather Shacker — forensic biologist * biology section: identify of body fluids: blood, semen saliva, and DNA analysis * casework approach: find material, identify, analyse (DNA), evaluate/compare (after able to create DNA profile), then lastly interpret * how does that work? 3 main groups of DNA profiling 1) science team — evaluates it, receives info on the case and a the stuff submitted, read case history and what examinations will be conducted and done a case assessment 2) screening unit - special training, to examine the body fluids take small sample to DNA unit 3)DNA unit — process it, then all the info goes back to scientific team to further analyze. * Hypothesis — based testing: way to decide what exanimations will be conducted, what Qs will be answered? Available evidence, results obtained * Detection of body fluids: conduct visual examinations (overhead lights/mag lights) and alternative light source for which are not entirely visible (such as semen which can luminance) * Examination for blood: 1) chemical test (kastle-meyer) rub it on paper and apply some chemicals and to look for pink color change, then usually send it to DNA analyzis, to question human or animal. 2)Human origin — ABA Card — hema trace, to look for 2 lines for human, 1 for animal * Examination for semen. 1) chemical test- acid phosphatase and P30 found in very high levels of semen 2) microscopic exam — take small portion of the item if acid phosphatase found in the area and use under microscope and stain the slide * Examination for saliva: never able to 100% confirm so we check for a part — amalyaze 1) chemical test- amylase, phadebas test. Look for a blue color

shade, color change fast is salvia or slow change can be other fluids * Limitations: 1)method of deposition — cannot determine there is blood because 2 ppl for into a flight of if someone got a nosebleed, how the fluid got there 2)date or time, it can stay on items for a long period of time, can be detecting the DNA many years later * What is DNA?: chemical blueprint of life, inherited from mother and father, same in all cells, different between people * When comparing DNA profiles, what are we looking for: 15 locations, 2 observations per location, differences in length (alleles, or pieces numbered according to length). { E. g Short Tandem Repeats (STRs) - homozygote (same number of repeats), or heterozygote (different number of repeats)} * Sources of forensic DNA evidence: blood, semen, saliva, hair, teeth, bone, tissue * A sensitive technique: if we smash up that smarty into a billion pieces, 1 of those DNA is how much we need to develop a DNA profile * Tissue Yields: 1 saliva — 3ng, 1 blood — 45 ng, 1 semen — 300 ng * DNA analysis process: 1) prepare the evidence, swab or cutting from evidence 2) sample prepared for DNA extraction - 2 types of extraction: a) conventional extraction, DNA from all the cells is collected into the tube. b) differential extraction: we know/think there might be DNA in the sample, we collect the DNA from everything that isn’t semen then to collect the DNA from sperm cells, we have 2 separate tubes now 3) after the tube measure how much DNA is present called quantitation, if enough DNA then we detect or copy the particular location (there are 15 possible locations), we copy each of those locations using a machine, and now have DNA profile, each of those bars at the top is the DNA and the peak underneath is the location * This profiling can determine the sex and if there was more than one or more person, but

cannot determine physical characteristics such as eyes, hair * Advantages and limitations: Forensic DNA analysis can tell us: sex, mixed vs. single course, exclusions, and statistics. It cannot tell us any physical characterises, or when and how sample was deposited. Kind of the same as body fluids * In DNA profile when someone is excluded it is 100% that they are not involved, either can or cannot be excludes as the source of the unknown DNA profile. Signification of non-exclusion? 1) Either the suspect is the source of the evidence DNA 2) Random match probability (RMP). We address that my doing some statistics and do a RMP Random Match Probability (RMP) * The probability that a randomly selected individual unrelated to Mr. Smith would coincidentally share the observed SNA profile is estimated to be 1 in 16 billion. * Why do we need this? * Don’t test all the DNA (only 15 locations) * Assume the true perpetrator could be anyone * Don’t have everyone’s DNA profile. National DNA databank (NDDB) * Convicted Offenders Index = individuals that have been convicted of offences * Crime Scene Index = unknown DNA profiles can be uploaded * Each index is compared — used as an investigative tool to link inter-related crimes and find suspects that are not considered. * Why do we need this? Because we don’t test all DNA we only test 15 locations, assume the true perpetrator can be anyone and we don’t have everyone’s DNA profile * We have national DNA databank (NDDB) 2 groups of DNA profiles: crime scenes * Some statistics: 235, 389 DNA added to COI * STR vs. Y-STR, * STR: both genders, inherited from both parents, shuffling combination of both parents then passed on to you. * Y-STR: males only, inherited from father, no shuffling, the guys have 2 types of DNA profiles, and father and son will have the same Y-STR profile.

Advantages: Males: female mixtures, if there is a sexual assault the sample may contain a large amount of female DNA it might overwhelm the male DNA. It’s excluding. Disadvantage: not as discriminating, shared profiles, incompatible with NDDB * Y-STR conclusions: Mr. Smith (5-1) and each of his paternal male relatives cannot be excluded as the course. Y-srt, “ my RMP is 1 in 333" * Y-SRT, why are they different? Method of inheritance, some of each info inherited from parents the shuffling happens. Or the counting method, first counted the amount of times seen in a big database, calculated in each of the racial groups, to see the maximum chance where it is seen. * One more type of DNA analysis: “ autosomal vs. Mitochondrial DNA". Autosomal: DNA in the nucleus, 1 copy per cell. Inherited from both parents, shuffling. Mitochondria — the energy house of the cell. Many copies per cell, inherited from mother, no shuffling, mother passes it down directly to her children * Advantages of mitochondrial DNA: results from degraded/old DNA, compare to any member of maternal line. Disadvantage: susceptible to contamination, not as discriminating, incompatible with NBBD. * Credits for employment: scientist: BA/BSc honors degree, specific classes: molecular bio, genetics, biochemistry, and statistics/population genetics. Technologist — on the job training. Based on FBI DNA advisory board for standard forensic DNA testing.