Forensic Genetics

Module 15 – Section 6 Exercises

Exercise 1a: Formulating Propositions

An individual is discovered looking into a house one night. The police are called and find a single cigarette butt under the window where the incident occurred. No one in the family smokes. The police have a person of interest captured on a neighbor's CCTV.

A single-source profile is obtained from the cigarette butt and the reference profile of a person of interest (POI) matches.

Exercise 1b: Formulating Propositions

A complainant calls 911 to report a sexual assault in her home. She is taken to a hospital where an intimate swab is collected.

A POI is identified from the investigation and the obtained profile from the swab is fully explained by a mixture of the complainant (K) and the POI.

Exercise 1c: Formulating Propositions

A complainant is cut with a knife during an altercation. Based upon eyewitness testimony, a POI is identified.

A stain on the clothing of the POI is tested for blood, and a DNA profile is developed that is consisted with a mixture of the POI and the complainant.

Exercise 1d: Formulating Propositions

Molotov cocktails have been thrown at random cars. An unexploded container is found in the street, and a 2 person mixture is developed from the evidence.

Two persons of interest are arrested.

Exercise 1e: Formulating Propositions

A complainant walking through a city park is attacked from behind and is sexually assaulted on a blanket. She didn't get a good look at the perpetrator. The police recognize the blanket as possibly belonging to a vagrant known to live near the park.

A profile obtained from the blanket is fully explained by mixing of K and POI's DNA.

Exercise 2: Base Rate Fallacy

- Of the women complaining of painful hardening of the breast, 1% have a malignant tumor: $Pr(C) = 0.01$.

- The accuracy ($+$ or $-$) of a mammography is 90%: $Pr(+|C) = Pr(-|C') = 0.9$.

- Estimate $Pr(C|+)$ to decide whether or not to order a biopsy.

Exercise 2: Base Rate Fallacy

Most physicians estimate $\Pr(C|+) \approx 0.75$, while the correct answer is:

Exercise 3a: Prosecutor's Fallacy

Do you think these statements are correct/incorrect/ambiguous?

- The evidence is much more likely if the DNA profile came from the suspect than if someone else left the sample.

Exercise 3b: Prosecutor's Fallacy

Do you think these statements are correct/incorrect/ambiguous?

- The probability of this DNA profile if it came from someone other than the suspect if very low.

Exercise 3c: Prosecutor's Fallacy

Do you think these statements are correct/incorrect/ambiguous?

- The probability that this DNA profile came from someone other than the suspect if very low.

Exercise 3d: Prosecutor's Fallacy

Do you think these statements are correct/incorrect/ambiguous?

- The probability of someone other than the suspect having this DNA profile is very low.

Exercise 3e: Prosecutor's Fallacy

Do you think these statements are correct/incorrect/ambiguous?

- The probability of someone other than the suspect leaving this DNA profile is very low.

Exercise 3f: Prosecutor's Fallacy

Do you think these statements are correct/incorrect/ambiguous?

- The evidence strongly supports the hypothesis that the DNA profile came from the suspect over the hypothesis that someone else left the sample.