

BIO 3020 - Applied Forensic Biology

Proposed Curriculum

The course will comprise lectures/discussions that will last 50 minutes and laboratories that will last 2 hours. In some cases, due to the nature of the laboratory work, the entire 3 hour period may be devoted to the laboratory. Both lectures and lab components are required. Lab protocols and readings will be discussed prior to students working in the lab. The envisioned schedule is meeting MWF for 3 hour lecture/lab sessions.

Instructors: Mark Bush and Charles Polson

Lectures:

1. Introduction: Applied biology in forensics.
2. The application of diatom analysis to forensics. Case studies.
3. Forensic entomology and initiation of laboratory activity to be revisited in week 3.
4. The role of palynology in forensics.
5. Discussion: Cumulative results weeks 1 and 2: Where did the body come from?
6. Forensic entomology and the succession of decomposers.
- 7 Mid-Term Exam
8. Introduction to DNA structure, eukaryotic genomes and genes.
9. SNPs, RFLPs, VNTRs, PCR, and DNA fingerprinting.
10. Human Alleles and allelic typing. Amplification of DNA using PCR and its use in forensics.
11. Discussion of allelic typing and genotypic frequency results.
12. Blood typing, mitochondrial DNA and parentage.
13. Ethical aspects of forensic DNA analysis.
14. Final Exam

Laboratories:

1. Introduction to diatom morphology, sampling, and identification. Processing samples.
2. Provenance of drowning.
3. Provenance of drowning.
4. Introduction to pollen morphology, sampling , and preparation.
5. Analysis of pollen from shoes and clothing to determine the scene of the crime.
6. Analysis of pollen from shoes and clothing to determine the scene of the crime.
7. Introduction to maggots, flies, and beetles.

8. Analysis of cadaver (raccoon*) decomposers.
*Raccoon cadavers will be provided by the Archie Carr and Sebastian Inlet State Parks where animals are trapped and euthanized in the course of turtle nest protection.
9. Constructing a time series of decomposers.
10. Familiarization with the laboratory; explanation and check-out on instrumentation..
11. Isolation and quantification of DNA isolated from human hair cells.
12. Isolation and quantification of DNA isolated from human hair cells.
13. Allelic typing of DNA from human hair. Calculation of genotypic frequency.
14. Allelic typing of DNA from human hair. Calculation of genotypic frequency.
15. Allelic typing of DNA from human hair. Calculation of genotypic frequency.
16. Introduction to the crime, presentation of evidence. Analysis of crime scene evidence.
17. Analysis of crime scene evidence.
18. Discussion of crime scene evidence. "Who done it?"

Grading: Total 400 pts

Midterm 100 pts

Final 100 pts

Laboratory participation (Bush) 100 pts

Laboratory participation (Polson) 100 pts

Readings for Bio 3020: Applied Forensic Biology

- Benecke, M. DNA typing in forensic medicine and in criminal investigations: a current survey. *Naturwissenschaften Aufsätze* 181-187.
- Catts, E.P & M. L. Goffú 1992 *Forensic Entomology in Criminal Investigations*. *Annual Review of Entomology* 37: 253-272.
- Furton, K.G., Hsu, Y.L. & Cole, M.D. (1999). What educational background do crime laboratory directors require from applicants? *Journal of Forensic Sciences*, 44(1), 128-132.
- Hall, M. & B. Turner *Forensic entomology a summary of collecting techniques*. www.mnh.uk. Natural History Museum, London. 3 pages.
- Holden, C. 1997. DNA Fingerprinting Comes of Age. *Science* 278: 1407.
- Hürlimann, J. et al. 2000. Diatom detection in the diagnosis of death by drowning. *International Journal of Legal Medicine* 114: 6 - 14.
- Kasai K, Nakamura Y, White R. 1990. Amplification of a variable number of tandem repeats (VNTR) locus (pMCT118) by the polymerase chain reaction (PCR) and its application to forensic science. *J. Forensic Sci.* 35:1196-200.

- Lord, W. D. 1990. Case histories of the use of insects in investigations. Pp. 9-37 in Entomology & death: A procedure guide (Catts, E. P. and N. H. Haskell, eds.). Joyce's Print Shop, Inc., Clemson, South Carolina, 182 pp.
- Mildenhall, D. 2004. An Example of the Use of Forensic Palynology in Assessing an Alibi. J Forensic Sci, 49 1-5.

Nowak, R. Forensic DNA Goes to Court with OJ. *Science* 265:1352-1354.

Olivier, N. 2001. The role of DNA in the investigation of crime: A case study of South African investigators. 2nd World conference on Modern criminal investigation, organized crime and human rights. 10 pages

Pickering, R.B. & E. Cuevas 2003. The Ancient Ceramics of West Mexico. *American Scientist* 412: 243-249.

Pollanen MS 1998 Diatoms and homicide. *Forensic Sci Int.*;91(1):29-34.

Roffey, P.E. and G.J. Harmon The Use of PCR Technology for Routine Grouping in the Forensic Biology Laboratory.

Sachs, J.S. (1998, November). A maggot for the prosecution. *Discover*, 19(11): 102-8.

Szibor et al. 1998. Pollen analysis reveals murder season. *Nature* 395: 449-450.

Zehner, R. et al. 2004. STR Typing of Human DNA from Fly Larvae Fed on Decomposing Bodies *J Forensic Sci*, 49, 1-4.