

San Jose State University
Department of Justice Studies

JS 190 Forensic Molecular Biology (01, Fall 2009)

General Class Information:

<i>Instructor:</i>	Dr. Steven Lee.
<i>Office Location:</i>	MacQuarrie Hall 521.
<i>Telephone:</i>	408-924-2948
<i>Email:</i>	steven.lee@sjsu.edu ; sblee999@gmail.com..
<i>Office Hours:</i>	Wednesday 1445-1845 Set by appointment via email.
<i>Class Days/Time:</i>	Monday and Wednesday 1330-1445.
<i>Classroom:</i>	Macquarrie Hall 520.
<i>Lab:</i>	Mondays 1630-2030.
<i>Prerequisites:</i>	Bio 3, Chem 1A, Chem 1 B: all with C or Better.

Course Description:

History, scientific concepts, methods, practices, instrumentation, interpretation, statistics and court issues of forensic DNA analysis via lectures, hands-on activities/laboratories, and videos. Collection, documentation and preservation of biological evidence, bioethics, QA, validation, admissibility and training will also be covered.

Course Text and materials:

Required Texts:

Butler, J. 2005. Forensic DNA Typing: Biology and Technology behind STR Markers. Burlington (MA): Academic Press. pp 1-688.

Rudin, N. and K. Inman. 2001. An Introduction to Forensic DNA Analysis. Boca Raton, (FL): CRC Press. pp 1-312

Forensic Biology Laboratory Protocols. Steven Lee. Crime laboratory protocols (publicly available). Protocols will be handed out and utilized for laboratory and hands-on exercises.

Required reading and Internet materials:

Journal articles and other readings will be accessible at the SJSU library, on reserve or will be accessible on line. Citations and URLs for on line materials will be provided in assignments and on the greensheet. These will include:

Molecular Biology Resource Page at <http://www.horizonpress.com/gateway/molbiol.html/>.

Several pages within the course will be assigned as additional reading

Harvard DNA project at <http://www.dnapolicy.net/>

President s DNA Initiative at <http://www.dna.gov/>

Jobling, MA and Gill, P. 2004. Encoded evidence: DNA in forensic analysis. *Nature Rev. Genet.* 5; 739-751.

Kaye, DH and Smith, ME. 2003. DNA Identification Databases: Legality, Legitimacy, and the Case for Population-Wide Coverage, *Wisconsin Law Review*, 2003(3): 414 -459.

NIST STRBase at <http://www.cstl.nist.gov/div831/strbase/index.htm>

NCJRS publications at: <http://www.ncjrs.gov>

DOJ links at: <http://www.ojp.usdoj.gov/nij/topics/technology/welcome.htm>

Human Genome Project Links at:

http://www.ornl.gov/sci/techresources/Human_Genome/elsi/forensics.shtml

and others at: http://www.forensic.to/links/pages/Forensic_Sciences/Field_of_expertise/DNA/ and [Genetic Witness: Forensic Uses of DNA Testing, Office of Technology Assessment at: http://govinfo.library.unt.edu/ota/Ota_2/DATA/1990/9021.PDF](http://govinfo.library.unt.edu/ota/Ota_2/DATA/1990/9021.PDF)

Supplementary Texts (Optional) - Course material may include citations from the following:

Review Readings from:

Watson, JD, Baker TA, Bell SP, Gann A, Levine M and Losick R. 2004. *Molecular Biology of the Gene*, 5th Ed., Pearson/Benjamin Cummings.

The Evaluation of Forensic DNA Evidence Committee on DNA Forensic Science: An Update, National Research Council 272 pages, 6 x 9, 1996, ISBN 0-309-05395-1 National Academies Press-

Evaluation of Forensic DNA Evidence Committee at: http://www.nap.edu/booksearch.php?term=the%20evaluation%20of%20forensic%20dna%20evidence&record_id=5141

Saferstein, R. 2004. *Forensic Science Handbook*, Vol. 2. Pearson. pp 1 -528.

Saferstein, RE. 2007. *Criminalistics: An Introduction to Forensic Science (College Version)*, 9/E. Prentice Hall. pp 1 -672.

An Introduction to Forensic Science at:

<http://vig.prenhall.com/catalog/academic/product/0,1144,0132216558,00.html>

Fisher, B. 2004. *Techniques of Crime Scene Investigation*, Seventh Edition. CRC Press. pp 1-544.

Course Format:

The course will include **lectures by the instructor and guest lectures** including scientists from crime laboratories, **hands-on laboratories** and activities, **discussions, videos, and small-group hands-on activities**. If possible, on-line chats and a visit to a crime lab will be scheduled (TBA).

Course requirements:

Exams - 350 points:

Three exams will be given in this course. Exams will be cumulative and will include all material covered up to the date of the exam. Exams may include multiple choice, matching, true/false, short answer, diagrams, drawings and sketches, short essay and/or long essay.

The final will be comprehensive. Exam 1 and exam 2 are both worth 100 points. The final is worth 150 points.

Quizzes and Small Group Activities - 100 points:

Quizzes on assigned readings, small group activities and other assigned materials will be given during the semester. These will generally be multiple choice, matching, true/false and short answer but may also include essay questions.

Hands-on Laboratory Assignments/Reports - 40 points:

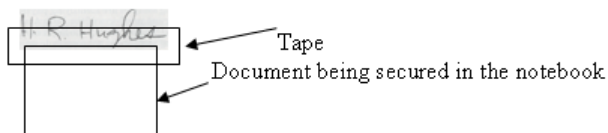
Laboratories will be held throughout the semester. These will include: Measurements and Error, Proper collection methods, Microscopy/Presumptive tests, DNA Extractions, Quantification of DNA, multiplex PCR amplification of STRs (autosomal and Y), PAGE vs CE, computer Short Tandem Repeats (STR) data analysis, mt DNA amplification and sequence analysis, and moot court testimony. Written reports for each of the activities will be required (see general guidelines for reports below). During the semester, at least 1 report from each team will be collected and reviewed. At the end of the semester all laboratory reports entered in notebooks will be collected. Participation will also be considered in the grades.

Guidelines for Laboratory Reports:

All reports must contain the following sections: Abstract, Introduction, Materials and Methods, Results, Discussion with Conclusions, References, and Appendices with raw data. In general, documentation of all the activities should be complete enough so that an independent scientist could repeat all of the steps and understand the critical reasoning and analytical interpretation of the data and conclusions of your reports. All pages must be numbered.

All the material must be presented in the following manner:

Documents are to be taped and then signed over the tape such that half of the signature is on the tape and half is on the notebook.



Report Grading:

Reports will be graded using both administrative and technical criteria. Details of format and grading of the reports will be provided at the first laboratory.

Grading in general includes the following considerations:

Administrative Criteria- Approximately 1 point each per crime scene report:

- Is the notebook bound (not spiral and no pages removed/loose) and are all crime scenes included?
- Is the chain of custody completed for any evidence transfers and documented appropriately? Are proper citations and acknowledgements documented for other individual's work (e.g. citations/references/teammates whole names)? Is the evidence, properly sealed and stored where indicated?
- Is the documentation complete? Do the reports include notes, sketches and photographs? Are all pages numbered, dated and initialed? Is all data properly and securely inserted into the notebooks?
- Where assigned, do the reports address the questions provided?
- Are the reports organized with all sections? Is the writing clear and legible?

Technical and Scientific Criteria- Approximately 1 point each per lab report:

- Are data tabulated/summarized and analyzed accurately?
- Does the data support the statements in the reports?
- Are the statements within the report and between team members consistent? If not, are discrepancies explained?
- Is the technical detail provided sufficient for court and would the CSI be able to reconstruct the "crime scene" years from now, based on the documentation?
- Are additional external references/citations utilized (those not provided in the class)?

Participation point grading- 10 points:

For in class and laboratory participation, you will be able to earn 10 points. You will be graded on your participation. For "outstanding" participation, you will be awarded 9-10 points. These will be awarded to students who participate fully each week including being on time, completing all assigned work, actively participating in group activities, providing several comments and questions during the activity/laboratory and on occasion, bringing to light additional information and references relevant to the topic.

For "good" participation, you will be awarded 6-8 points. This level will be achieved by those that are on time most of the time, completing nearly all assigned work, participating some in group activities and providing some comments and questions during the activities. "Fair" participation (some assigned work completed, a few comments or questions made, or students who participate considerably but arrive more than 15 minutes late or leave more than 15 minutes early or those missing 2-3 laboratory sessions) will be awarded 3-5 points. Minimal participation (very little completed work, almost no comments, consistently late arrival or early to leave) will be awarded 1-2 points. Students who are completely silent or are absent more than 4 times from laboratories will receive no participation points.

Grading:

Quizzes/Activities	100 points;
Exam 1	100 points;
Exam 2	100 points;
Laboratory notebooks	40 points;

Participation	10 points;
Final exam	150 points;
Total required	500 points.

Extra Credit:

A total of 10 points may be granted for additional extra credit small group assignments and other assignments during the semester. Each assignment will be worth 1-2 points each. These extra credit points may be used to augment your final point total.

Grading Policies:

Make-up exams will not generally be permitted. However, under extraordinary circumstances, with proper documentation and approval by the instructor, a 15 page single-spaced term paper of an instructor assigned topic, may substitute for 1 exam.

Grading Scale (plus/minus)

<i>From - To</i>	<i>Grade</i>
483.5-500	A plus
467-483.4	A
450-466.9	A minus
433.5-449.9	B plus
417-433.4	B
400-416.9	B minus
383.5-399.9	C plus
367-383.4	C
350-366.9	C minus
333.5-349.9	D plus
317-333.4	D
300-316.9	D minus
<300	F

Instructor:

Professor Lee holds an MS from NYU and PhD from University of California, Berkeley in Molecular Biology. Lee holds several concurrent positions including a consulting position as Director of R&D at MiraiBio Inc. a small biotech company in Alameda, CA, Visiting Scholar at UC Berkeley, and holds

adjunct professor appointments in Biological Sciences at San Francisco State University and Chemistry at Florida International University. He was formerly the Director of R&D at CA Dept of Justice DNA Laboratory from 1994-2000 where he served as an expert witness in DNA and conducted DNA training courses. He is a full member of the American Association for the Advancement of Science, American Academy of Forensic Sciences, the California Association of Criminalists, and is an American Society of Crime Laboratory Directors Laboratory Accreditation Board certified inspector. He also served on the FBI Technical Working Group on DNA Analysis Methods group from 1994-2000. He has taught courses in molecular biology at SFSU (1996-1998), Forensic genetics at UC Davis (1997), and most recently forensic DNA Typing of STRs at FIU (2003).

University Policies:

Course Add/Drop Statement:

Instructors are permitted to drop students who fail to attend the first scheduled class meeting and who fail to inform the instructor prior to the second class meeting of the reason for any absence and their intention to continue in the class. Some instructors will drop students who do not meet the stated course prerequisites. However, instructors are not required to drop a student from their course. **It is the student's responsibility to make sure classes are dropped.**

You, the student, are responsible for understanding [the policies and procedures about add/drops, academic renewal, withdrawal, etc. found at: \[http://sa.sjsu.edu/student_conduct\]\(http://sa.sjsu.edu/student_conduct\)](#)

Dropping and Adding:

Students are responsible for understanding the policies and procedures about add/drops, academic renewal, etc.

[Information on add/drops are available at <http://info.sjsu.edu/web-dbgen/narr/soc-fall/rec-324.html>](http://info.sjsu.edu/web-dbgen/narr/soc-fall/rec-324.html)

[Information about late drop is available at <http://www.sjsu.edu/sac/advising/latedrops/policy/>](http://www.sjsu.edu/sac/advising/latedrops/policy/)

Students should be aware of the current deadlines and penalties for adding and dropping classes.

Academic integrity:

Students should know that [the University's Academic Integrity Policy is available at \[http://www.sa.sjsu.edu/download/judicial_affairs/Academic_Integrity_Policy_S07-2.pdf\]\(http://www.sa.sjsu.edu/download/judicial_affairs/Academic_Integrity_Policy_S07-2.pdf\)](http://www.sa.sjsu.edu/download/judicial_affairs/Academic_Integrity_Policy_S07-2.pdf)

Your own commitment to learning, as evidenced by your enrollment at San Jose State University and the University's integrity policy, require you to be honest in all your academic course work. Faculty members are required to report all infractions to the office of Student Conduct and Ethical Development.

[The website for Student Conduct and Ethical Development is available at:](http://www.sa.sjsu.edu/judicial_affairs/index.html)

http://www.sa.sjsu.edu/judicial_affairs/index.html

Instances of academic dishonesty will not be tolerated. Cheating on exams or plagiarism (presenting the work of another as your own, or the use of another person's ideas without giving proper credit) will result in a failing grade and sanctions by the University. For this class, all assignments are to be completed by the individual student unless otherwise specified. If you would like to include in your assignment any material you have submitted, or plan to submit for another class, please note that SJSU's Academic Policy F06-1 requires approval of instructors.

Academic integrity is essential to the mission of San José State University. As such, students are expected to perform their own work (except when collaboration is expressly permitted by the course instructor) without the use of any outside resources. Students are not permitted to use old tests, quizzes when preparing for exams, nor may they consult with students who have already taken the exam. When practiced, academic integrity ensures that all students are fairly graded. Violations to the Academic Integrity Policy undermine the educational process and will not be tolerated. It also demonstrates a lack

of respect for oneself, fellow students and the course instructor and can ruin the university's reputation and the value of the degrees it offers.

We all share the obligation to maintain an environment which practices academic integrity. *Violators of the Academic Integrity Policy will be subject to failing this course and being reported to the Office of Judicial Affairs for disciplinary action which could result in suspension or expulsion from San José State University.*

[The policy on academic integrity can be found at
http://www.sa.sjsu.edu/download/judicial_affairs/Academic_Integrity_Policy_S07-2.pdf](http://www.sa.sjsu.edu/download/judicial_affairs/Academic_Integrity_Policy_S07-2.pdf)

Campus Policy in Compliance with the American Disabilities Act:

If you need course adaptations or accommodations because of a disability, or if you need to make special arrangements in case the building must be evacuated, please make an appointment with me as soon as possible, or see me during office hours. Presidential Directive 97-03 requires that students with disabilities requesting accommodations must register with the DRC (Disability Resource Center) to establish a record of their disability.

Cheating:

At SJSU, cheating is the act of obtaining or attempting to obtain credit for academic work through the use of any dishonest, deceptive, or fraudulent means. Cheating at SJSU includes but is not limited to:

- Copying in part or in whole, from another's test or other evaluation instrument.
- Submitting work previously graded in another course unless this has been approved by the course instructor or by departmental policy.
- Submitting work simultaneously presented in two courses, unless this has been approved by both course instructors or by departmental policy.
- Altering or interfering with grading or grading instructions.
- Sitting for an examination by a surrogate, or as a surrogate.
- Any other act committed by a student in the course of his or her academic work which defrauds or misrepresents, including aiding or abetting in any of the actions defined above.

Plagiarism:

At SJSU plagiarism is the act of representing the work of another as one's own (without giving appropriate credit) regardless of how that work was obtained, and submitting it to fulfill academic requirements. Plagiarism at SJSU includes but is not limited to:

The act of incorporating the ideas, words, sentences, paragraphs, or parts thereof, or the specific substances of another's work, without giving appropriate credit, and representing the product as one's own work; and representing another's artistic/scholarly works such as musical compositions, computer programs, photographs, painting, drawing, sculptures, or similar works as one's own.

Student Rights and Responsibilities:

"The classroom is the essential part of any university. Both freedom to teach and freedom to learn should flourish in the classroom. The professor has the right and responsibility to control the classroom; however, as this control is exercised, the rights of students as set forth in this document should not be denied.

1. Students have the right to consistent and judicious evaluation by the instructor.
2. Students are free to take reasoned exception to the data or views offered in courses of study. They may be required to know the material set forth by the instructor, but they are free to reserve personal judgment as to the truth or falsity of what is presented.

3. Students have the right to have faculty meet their classes at the scheduled times and make presentations appropriate to the course. When circumstances require cancellation of a class, the instructor shall make an effort to notify students.
4. While faculty and administrators have primary responsibility in curricular matters, students shall have opportunity for participation in revising and improving the curriculum by serving on operational curriculum committees.
5. Students are responsible for meeting standards of academic performance established for each course. Performance in the course shall be the sole criterion by which students are measured and the professor shall take no action to penalize students because of their opinions or because of their conduct outside the classroom in matters unrelated to the class. Students have the right to a course grade which is a just measurement of performance in the course.
6. Information about a student's performance, views, beliefs, and political association which professors acquire in the course of their work as instructors, advisers, and counselors is considered confidential.
7. Students enrolled in a class may be denied admission to the classroom or may be expelled for the remainder of a class period only for considerations relevant to the educational purposes of the class. A faculty member may recommend to the Dean of Student Services that a student be permanently withdrawn from a course if after suitable warning a student's disruptive actions are determined to be in violation of the University policy on "Student Discipline Relating to Conduct on State University Campuses".
8. Students have the right to have instructional faculty schedule a reasonable number of office hours for student conferences".

Tentative Course Schedule:

Dates	Topics	Butler/*Inman.
Week 1:	Overview of Forensic DNA typing and History of Forensic DNA	C1/ C3&C5.
08/24 and 08/26.	Handouts-Syllabus- Reading material. guide. Introductions: Your background, my background. Course Description, requirements, grading etc. Set up small student groups. Assignment 1- Required reading: Brettell, TA, Butler, JM, and R. Saferstein. Forensic Science. Anal. Chem 3839-3860. Spencer, C. 2004. Genetic Testimony: Introduction and Questions about DNA Profiling Methods. Lee, SB. 2006. Forensic DNA Typing. McGraw-Hill Yearbook of Science and Technology. McGraw-Hill In press. To be distributed.	Safety/report
	<u>Visit the President s DNA Initiative Web site at http://www.dna.gov</u>	
	Laboratory: Read Safety and laboratory format and grading handout.	
	<i>Complete SJSU safety training on line.</i>	
	<i>Optional reading:</i>	
	1. The Human Genome Project and Beyond at <u>http://www.ornl.gov/sci/techresources/Human_Genome/publicat/primer2001/index.shtml</u>	
	2. <u>Church, GM. 2006. Genomes for All. Scientific American. 294: 47 -54.</u>	

3. [DNA Glossary at: http://forensicdnaconsultant.com/Glossary.htm](http://forensicdnaconsultant.com/Glossary.htm)
4. [PBS links on DNA at http://www.pbs.org/saf/1202/features/genelinks.htm](http://www.pbs.org/saf/1202/features/genelinks.htm)
5. [DNA learning center at: http://www.dnalc.org/home.html](http://www.dnalc.org/home.html)
6. [Weedn, VW- Unrealized potential of DNA testing at http://www.ncjrs.org/pdffiles/170596.pdf](http://www.ncjrs.org/pdffiles/170596.pdf)

Week 2: Biological Physical Evidence

08/31. No Class- Furlough Day

Butler Chapter 3

09/02. Basics of Biological Physical Evidence

Butler C3/In C1-C2.

Introduction to Physical Evidence. **Common Types of Physical Evidence. - The Significance of Physical Evidence.**

Locard's Exchange Principle- Class vs Individual Characteristics.

Laboratory: Measurement and Errors: Measurements Impact angle calculations

Biological Physical Evidence: Different types of biological physical evidence.

Assignments- Required Reading:

Visit www.dna.gov at: http://www.dna.gov/basics/evidence_collection. Read all sub pages (all blue sub links in each of the sections): Crime Scene Integrity, Chain of Custody, Contamination of Evidence, Evidence Transportation and Storage, Sources and Locations of DNA Evidence.

Week 3 Identification of biological evidence: Intro to Detection and Screening methods.

09/07 No Class- Holiday- Labor Day

Butler Chapter 2

09/09 Biochemistry of biological evidence: blood, saliva, semen.

Introduction to

screening methods to be handed out. Laboratory: Evidence screening Presumptive testing of blood, saliva and semen.

1. Visual and Microscopic examination.
2. Enhancement reagents and imaging to screen for biological fluids.
3. Sampling/Evaluation of Biological Evidence.

Assignments: Required Reading.

References at <http://www.fbi.gov/hq/lab/fsc/backissu/july1999/ponce.htm>

Cox, M. 1991. A Study of the Sensitivity and Specificity of Four Presumptive Tests for Blood. Journal of Forensic Science 36(5):1503 -1511.

**Biochemistry of biological evidence continued
detection of biological evidence.**

Butler C2 / Inman C4. New methods for

Introduction to fluorescence.

Laboratory: Documentation, Collection and preservation of biological evidence-

Week 4 Collection and preservation of Biological Evidence Butler C3/InmanC2.

09/14. Review –types of biological evidence.Collection methods for different types of evidence.Comparison of forensic biological evidence versus clinical samples.

Laboratory: Collection and preservation of biological evidence- continued.

09/16. Proper methods of collection. Special collection guidelines for Biological Evidence. Laboratory comparison of collection methods and kits. Chain of custody and storage.

Required reading on training at: <http://www.dna.gov/training/>

Take both training courses on what every law enforcement officer should know about DNA evidence- Selected pages will be assigned.

Laboratory: Collection and preservation of biological evidence continued.Proper methods of collection. Special collection guidelines for Biological Evidence. Laboratory comparison of collection methods and kits. Chain of custody and storage.

Other collection devices.

Swab drying chambers/CEPs/FTA paper.

Temperature and tube comparisons for DNA storage and new collection substrates.

Assignment: Required Reading:

Collection and Preservation of Physical Evidence-
Chain of Custody or **The Real CSI.**

Special collection guidelines for Biological Evidence.

Spear, T.

Link for DNA Sample Handling at: http://www.cacnews.org/training/DNA_Sample_Handling.pdf

Additional Optional Readings:

Kobilinsky, L. 1992. Recovery and Stability of DNA in Samples of Forensic Science Significance. Forensic Sci. Rev. 4:67.

Gialamas, D and Stockwell, D. 1995. Forensic Biology Sample Collection and Handling Techniques. A Look at Methods Utilized by California Crime Labs CAC Newsletter. Summer 1995.

Week 5 Biochemistry of DNA and Human Genetics: DNA Structure, Function and Replication, Cell Biology, Chromosomes, Genes and Forensic DNA markers DNA Biology- The Scientific Basis for DNA typing ButlerC2/InmanC4.

09/21. Introduction to DNA and Basic Human Genetics.Scientific Basis for DNA typing - Why DNA?

Intro to Deoxyribonucleic Acid: Central Dogma- DNA extraction.

Genetic Code, DNA Structure, Function and Replication.

Cell Biology, Chromosomes, Genes and DNA markers.

Laboratory: DNA extractions: Phenol chloroform vs. other extractions. Chelex, FTA, Silica based, Prepfiler.

09/23. Differential extraction of male vs. female DNA from sexual assault evidence.

Basic Human Genetics- *A tribute to Mom and Dad.* Butler C 19. Inheritance of DNA – Mendelian Genetics DNA variation and DNA Methods. **Go to Methods in Molecular biology- Go to the fundamentals- section 6:-**

DNA/RNA structure at:
http://www.blc.arizona.edu/Molecular_Graphics/DNA_Structure/DNA_Tutorial.html.

Week 6: Methods used in Forensic DNA : DNA extractions and quantification BC3/ IC5&C6

09/28 and 09/30- Video and Web based assignments will be used to cover these topics.

Lee will be conducting a Forensic Science Program inspection this week off campus.

09/28. DNA extractions- Types and amount of samples required for DNA typing.

DNA Extraction and Quantification or *How do they get DNA?*

Overview of Typing- Methods used to isolate DNA and Quantify DNA **How much DNA do they need?**
DNA from a Cougar- *Whos' DNA is it? Human or Non-human?*

09/30. Quantification of DNA : Non nucleic acid-based quantification methods.

Macroscopic and Microscopic examination.

Chemical and immunological methods.

Total genomic methods- DNA based:

Both intact and degraded.

UV Spectrophotometry.

Pico-green homogeneous microtitre plate assays.

Intact vs. Degraded DNA:

Agarose yield gel electrophoresis.

Human and higher primate specific methods – DNA based.

Both intact and degraded:

Slot Blot Hybridization using a D17Z1 probe.

AluQuant.

Intact vs. Degraded DNA:

Southern analysis of agarose yield gel-blots with D17Z1.

Real-time PCR, DNA-based human target specific methods.

Total human autosomal DNA.

Real-time PCR.

Multiplex Real-Time PCR:

Intact vs. Degraded DNA.

End-point PCR DNA quantification.

RNA based quantification methods.

Sources of Variation in Quantification methods: DNA quantification standards.

Interlaboratory studies on DNA quantification.

Week 7: Exam 1

10/05. **Review for Exam 1: Student led reviews** **Butler C1-C3&19/ Inman C1-C6.**
Laboratory- qPCR continued. QPCR computer interpretation and analysis.

10/07. Exam 1 covering Butler C1-C3&19/ Inman C1-C6, URLs, journal articles, lab protocols and laboratory exercises that have been assigned, videos and any guest lecturers.

Week 8: Methods used to assess DNA variation **ButlerC1&4/Inman C6.**

Note on weds 10/14 Lee will be attending and presenting at the 20th International Symposium on Human ID. Course topics will be covered by video and web assignments.

10/12. Restriction Fragment Length Polymorphisms, Polymerase Chain Reaction, Dideoxy sequencing, Denaturing High Performance Liquid Chromatography (dHPLC), Single Nucleotide Polymorphism, Detection using array-based tech.

Evaluating DNA variation or *Does size matter?*

Introduction to RFLP vs PCR

Laboratory:Restriction Digests- role of positive controls, negative controls.

Electrophoresis in a Classroom. PCR introduction.

10/14. Introduction to Polymerase Chain Reaction – *Who wants to be a DNA billionaire?*[Introduction to Polymerase Chain Reaction at: http://www.pcrlinks.com/generalities/introduction.htm](http://www.pcrlinks.com/generalities/introduction.htm)[Introduction to Polymerase Chain Reaction at: http://www.accessexcellence.org/RC/VL/GG/polymerase.html](http://www.accessexcellence.org/RC/VL/GG/polymerase.html)

Week 9: Introduction to STR markers **Butler C5,6&7/ InmanC6-C7.**

10/19. Furlough Day- No class

10/21 STRs- Short Tandem Repeats- CODIS loci.

Laboratory: PCR amplification –positive controls, negative controls -STR amplification.

Web Link for STRSTR at: <http://www.cstl.nist.gov/biotech/strbase>Budowle B, Shea B, Niezgoda S, Chakraborty R. 2001. CODIS STRSTR loci data from 41 sample populations. J Forensic Sci.ence 46(3):453 -489.

Additional Optional Readings:Walsh et al. 1996 NAR. 24:2807 -2812, Levinson et al. 1987. Mol Biol Evol. 4:203 -221, Brinkmann. 1998 Am J Hum Genet 62:1408, Henke et al. Am J Hum Genet 64:1473.

Week 10.. STRs continued

10/26. Short Tandem Repeats- Repeat Slippage- The bad zipper.

Repeat Slippage, Mutation rates, Chromosomal abnormalities and consequences on Forensic STR results.Reading:Moxon ER and Wills C. DNA Microsatellites: agents of evolution? Scientific American January: 72 -77, 1999.

10/28. Designating True alleles versus artifacts.

Week 11: Data collection (instrumentation) and Interpretation C12-15/C6-C8.

11/02. DNA separation methods- Gels vs Capillaries.

STR detection methods - Introduction to Fluorescence. [Introduction to Fluorescence techniques at: http://probes.invitrogen.com/handbook/sections/0001.html](http://probes.invitrogen.com/handbook/sections/0001.html)

Laboratory : CE: Introduction to the ABI 310 and 3130.

11/04. Understanding STR results: C18-19& C7/ C4&C8.

Introduction to population statistics. Population Stats - Genetics- Hardy-Weinberg Equilibrium-

Week 12: Exam 2.

11/09. Student Led Exam 2 Review Butler C5-7, 12-15/Inman C6-8.

Laboratory: CE: ABI 310 set up and detection continued. Computer laboratory analysis of STR data. Genemapper ID and Image analysis.

11/11. Exam 2 Covering Butler C5-7, 12-17/Inman C6-8 URLs and journal articles lab protocols and laboratory exercises that have been assigned, videos and any guest lecturers.

Week 13: Understanding STR results, Forensic Issues& DNA Databases

11/16. Statistics of single source samples and mixtures. Butler C7, 19-21& C7/In C4&C8.

Computer laboratory: Troubleshooting STR results-forensic issues.

11/18. Degraded DNA, PCR inhibition, contamination, mixed samples and Interpretation.

SWGAM STRSTR Interpretation Guidelines at <http://www.fbi.gov/hq/lab/fsc/backissu/july2000/strig.htm>

Combined DNA Index System- Value of DNA databases.

Levels of CODIS, Privacy Issues, QC, Searching, sample collection.

[Combined DNA Index system at: http://www.fbi.gov/hq/lab/html/codis1.htm](http://www.fbi.gov/hq/lab/html/codis1.htm)

Assignments- Required Readings:

Spencer C. 2004. Genetic Testimony: Questions about Interpreting DNA Profiles.

Why are DNA Profiles interpreted in terms of probabilities? How Are DNA Profile Probabilities Calculated and Presented? Is a Person's DNA Profile Unique? If a Defendant's Profile Matches That of the Crime Scene Sample, Does That Prove the Defendant's Guilt?

Population Stats - Genetics- Hardy-Weinberg Equilibrium Butler19-21/IC8

Assessing the strength of the Evidence.

11/23. DNA databases- Unsolved crimes -CHOP.

Combined DNA Index System- Value of DNA databases - Levels of CODIS, Privacy Issues, QC, Searching, sample collection- DNA Database Laws- International DNA databases - Cold Hits/ Unsolved crimes Innocence Project- Uses of DNA in exonerating the innocent.

- [Summary of the Key provisions of Proposition 69 at: http://www.aslme.org/dna_04/spec_reports/cal_prop_69.pdf](http://www.aslme.org/dna_04/spec_reports/cal_prop_69.pdf)
- Walsh, SJ. 2005. Legal Perceptions of Forensic DNA profiling Part I: A review of the legal literature. *Forensic Science International* 155(1):51-60.
- Judicature Genes and Justice, [The Growing Impact of the New Genetics on the Courts at: http://www.ornl.gov/sci/techresources/Human_Genome/publicat/judicature/](http://www.ornl.gov/sci/techresources/Human_Genome/publicat/judicature/)
- Combined DNA Index system at: <http://www.fbi.gov/hq/lab/html/codis1.htm>
- Kaye, DH and Smith, ME. 2003. DNA Identification Databases: Legality, Legitimacy, and the Case for Population-Wide Coverage, *Wisconsin Law Review*, 2003(3): 414-459.

Laboratory:

Report writing and statistics. Technical and Administrative review of forensic STR reports. Court testimony.

Forensic DNA database issues- Familial Searching, Privacy and Ethical Issues.

Gender typing, Amelogenin and Y STRs or is it a boy or a girl? Butler C 18, 20, 24.

Assignments- Required Reading:

Bieber F, Brenner CH, and Lazer D. 2006. Finding Criminals through DNA of their Relatives. *Science*. 312(5778):1315 -1316.

Additional reading:

- Butler, JM. 2006. Genetics and Genomics of Core Short Tandem Repeat Loci Used in Human Identity Testing. *J For Sci*. 51:253 -265.
- [Report of the National Task Force on Privacy, Technology, and Criminal Justice Information at: http://www.ojp.usdoj.gov/bjs/pub/pdf/rntftpcj.pdf.](http://www.ojp.usdoj.gov/bjs/pub/pdf/rntftpcj.pdf)
- [Ethical Legal and Social Issues Raised by the Human Genome Project Research at: http://www.ornl.gov/sci/techresources/Human_Genome/elsi/elsi.shtml.](http://www.ornl.gov/sci/techresources/Human_Genome/elsi/elsi.shtml)
- Streisand, B. 2006. Who's Your Daddy? Sperm donors rely on anonymity. Now donor offspring (and their moms) are breaking down the walls of privacy. *US News and World Report* 140:53 -56.
- **Nilstun, T and G. Hermeren. 2006. Human tissue samples and ethics. *Medicine, Health Care and Philosophy*. 9:81 -86.**
- Ethical, Legal and Social Implications of Genetic Testing at: [http://www.genome.gov/page.cfm?pageID=12010621.](http://www.genome.gov/page.cfm?pageID=12010621)

11/25. The “new” genetic markers- mtDNA and Y chromosome markers Butler C8-11.

Mitochondrial DNA: Inheritance, heteroplasmy, ancient DNA, Armed Forces DNA Identification laboratory applications. Laboratory: Mitochondrial DNA sequencing laboratory or Y STR amplifications.

Y chromosome markers

Butler C 8 and 9.

Overview of Y

Brief History of the Y chromosome.

Forensic Applications. Other applications.

Structure and Biology of the Y chromosome.

Y polymorphisms- SNPS and STRs.

Y databases.

Week 15: Quality Control, Validation, Admissibility, and Training Standards

11/30. Furlough Day. No class. See Required readings below on Validation and Ethics.

Butler Ch 16, A IV&V, In10-11.

12/02. Scientific and Technical Working Groups on DNA Analysis Methods.

DNA Advisory Board (DAB), Validation and Accreditation.

Required Reading:

1. Holt CL, Buoncristiani M, Wallin JM, Nguyen T, Lazaruk KD, Walsh PS. 2002. TWGDAM validation of AmpFISTR™. PCR amplification kits for forensic DNA casework. *J Forensic Sci.* 47(1):66 –96.

Required Reading:

2. CAC Code of Ethics at <http://www.cacnews.org/membership/handbook.shtml>

Additional Reading: Educational standards for Forensic DNA analysts and court issues.

Admissibility Standards and Testimony: Inman C11.

[Frye, Daubert and Federal Rules of Evidence at http://www.forensic-evidence.com/site/EVID/EL00003_4.html](http://www.forensic-evidence.com/site/EVID/EL00003_4.html)

STRSTR admissibility information at http://denverda.org/DNA/DNA_INDEX.htm

Legal/ethical considerations of DNA typing and Future of Forensic DNA in C 11.

Legal/Ethical Considerations of DNA typing:

See URLs.

Ethics of Genetic Testing at <http://www.nhgri.nih.gov/12010621>

AN INTERNATIONAL DNA DATABASE: **[BALANCING HOPE, PRIVACY, AND SCIENTIFIC ERROR at http://www.bc.edu/bc_org/avp/law/lwsch/journals/bciclr/24_2/05_FMS.htm](http://www.bc.edu/bc_org/avp/law/lwsch/journals/bciclr/24_2/05_FMS.htm)**

Innocence Project- Uses of DNA in exonerating the innocent-

[Exonerating the wrongfully convicted through post conviction DNA testing at:](http://www.innocenceproject.org)

<http://www.innocenceproject.org> Convicted by Juries, Exonerated by Science-

Case studies at <http://www.ncjrs.org/pdffiles/dnaevid.pdf>

Week 16. Future of DNA typing- Forensic Phenotype Profiling.

12/07 Future of DNA Testing: Inferring population of Origin from DNA.

12/07 Laboratory: Final Laboratory to be used for catch up and student led reviews for the final exam

Assignments: Required Reading:

- Sobrino, B., Brion, M., Carracedo, A. (2005) SNPs in forensic genetics: a review on SNP typing methodologies. *Forensic Sci Int.* 154(2-3):181 -194.
- Wetton J, Tsang K, and Khan H. 2005. Inferring population of origin of DNA evidence within the UK by allele-specific hybridization of Y SNPs. *For. Sci Intl.* 152(1): 45 -53.
- Cho, M and P. Sankar. 2004. Forensic genetics and ethical, legal and social implications beyond the clinic. *Nature Genetics Supplement.*36 (11):S8 -S12.
- Shriver, M, Frudakis T, and Budowle B. 2005. Getting the science and the ethics right in forensic genetics. *Nature Genetics* 37(5) 449 -450.
- Morin, PA, Luikart G, Wayne RK, and the SNP workshop group. 2004. SNPs in ecology, evolution and conservation. *Trends in Ecology and Evolution.* 19:208 -216.
- Webster, MT. and Smith NGC. 2004. Fixation biases affecting human SNPs. *Trends in Genetics.* 20:122 -126.

Final exam: Monday December 14th: 1215-1430.