

CHM 585 SELECTED TOPICS IN ADVANCED CHEMISTRY  
-- Trace Evidence and Microscopic Analysis --  
Fall 2007

**Course Information**

Meeting: 09:00 - 09:50 TuTh, Room 104, CFS.

Lab: 13:00 – 16:50 Th, Trace Lab (Room 205, 236) and Instrument lab (Room 234), CFS (Chemistry and Forensic Science Building)

**Instructor**

Dr. Chi Chung Yu (Jorn Yu)

Office: CFS 221 F

Office hours: 01:00-02:00 pm MTWTh, by appointment, or drop by.

E-mail: [jornyu@shsu.edu](mailto:jornyu@shsu.edu)

Phone: 936-294-4412

Research web page: [www.shsu.edu/~ccy002](http://www.shsu.edu/~ccy002)

**Textbooks**

1. Forensic Science Handbook I., Editor: Richard Saferstein, Prentice Hall. ISBN 10: 0-13-091058-9, 2<sup>nd</sup> edition, 2002.
2. Forensic Science Laboratory Manual and Workbook, Thomas Kubic, Nicholas Petraco, Taylor & Francis, ISBN: 0-8493-2132-8, 2005.
3. Selected articles from Journal of Forensic Science and Forensic Science International.

**Course Description**

This course will review the classifications and characteristics of trace evidence and provide hands-on experiments of microscopic techniques in trace evidence examination commonly employed in a crime laboratory. A variety of chromatographic, spectroscopic and microscopic techniques used for the analysis of fibers, hair, gunshot residue, ink, paints, explosives and narcotics will also be introduced. The course includes a four hour laboratory. Prerequisite: graduate standing in chemistry or forensic science. Credit 4.

**Course Objective:**

The objective of this course is to give students hands-on experiences in trace evidence examination. Major instrumentations in this course are Stereo Microscope, Polarized Light Microscope (PLM), Ion Mobility Spectroscopy (IMS), Micro Fourier Transform Infrared Spectrometer (Micro-FT-IR), Pyrolysis-Gas Chromatography-Mass Spectrometry (Py-GC-MS), Ultra Fast Liquid Chromatography - Tandem Mass Spectroscopy (LC-MS-MS) and Scanning Electron Microscopy – Energy Dispersive Spectroscopy (SEM-EDX). Historical review of trace evidence, case reports, and journal articles will be studied in order to provide solid understanding of this type of evidence, as well as advanced knowledge of trace evidence examination. Completion of this course

will advance students' knowledge in forensic trace evidence examination. Specific course objectives are listed as the following:

1. Review historical perspective of trace evidence, current stage of knowledge and future development in this field.
2. Understand scientific interpretation of trace evidence with an emphasis of chain of custody.
3. Familiarize students with the physical examination and chemical analysis of trace evidence.
4. Understand significance and limitations of trace evidences both in the investigative stage and in the trial stage.
5. Anything can be trace evidence, this course will cover the most frequently encountered types in criminal investigation, includes paints, fibers, hairs, gunshot residues (GSR).
6. Explore a variety of microscopic techniques in trace evidence examination, includes but not limited to bright field, dark field, polarized light, differential interference contrast (DIC), orthoscopic and conoscopic observations, and fluorescence.
7. Apply SEM-EDX for GSR identification.
8. Train students to evaluate analytical methods published in the scientific literature and present those findings orally.

### **Course Design**

The course is designed to cover microscope examination of different types of trace evidence. Classification and characteristics of trace evidence will be reviewed by the instructor. General procedures for trace evidence examination, includes physical and chemical techniques, will be covered by lab works.

### **Laboratory**

There will be a four-hour lab per week in this course. Students will be grouped, and assigned to labs each week. Students need to attend the lab as scheduled, and review lab procedures before the lab. Completion of all labs is required for receiving a passing grade.

### **Grading in This Course**

There will be lab reports (20%), one interview exam (10%), one oral presentation (20%), one mid term paper (20%) and one final term paper(30%) for grading in this course.

Assignment	Topic	Marks
Lab reports	On each lab topic	20%
Interview Exam	Techniques of Microscope	10%
Presentation	Physical or chemical examination of trace evidence	20%
Mid term paper	Recognition of Trace Evidence	20%
Final Term Paper	Trace Evidence Analysis/ Examination	30 %

Grade scale:

90 – 100	A
80 – 89	B
70 – 79	C
60 – 69	D
Below 60	F

Lab reports are due one week after the completion of the lab. You don't need to print out your lab report. Submit your lab report to Blackboard system. DUE IS FIRM. If you have difficulties in writing a report or you need more time to complete your lab work, please inform me before the due date.

**Tentative Schedule of Lectures and Labs**

Week	Topic	
Aug. 21	The Importance of Trace Evidence	
Aug. 28	Scope of Trace Evidences in Forensic Science	
Sept. 4	Trace Evidence in Forensic Crime Scene Investigation	
Sept. 11	Trace Evidence Examination	
Sept. 18	Forensic Microscopy I - Techniques in Microscope	
Sept. 25	Forensic Microscopy II – Polarized Light Microscope	
Oct. 2	Classification of Trace Evidence (Paints, Fibers, Hairs, Gunshot Residues (GSR))	
Oct. 9	Paints and Polymers	
Oct. 16	Hairs and Fibers	
Oct. 23	Scanning Electron Microscope – Energy Dispersive X-ray Spectrum (SEM-EDX) for Trace Evidence Analysis	
Oct.30 Nov.1	Application of Pyrolysis-Gas Chromatography-Mass Spectrometry (Py-GC-MS) for Trace Evidence Analysis	
Nov.6	Application of Ultra Fast Liquid Chromatography – Mass-Mass Spectrometry (UFLC-MS/MS) for Trace Evidence Analysis	
Nov. 13	Ion Mobility Spectroscopy (IMS) for Screening Trace Evidence	
Nov. 20	Thanksgiving Holiday	
Nov. 27	Context Effect (Confirmative Bias) in Forensic Trace Evidence Examination	
Dec. 4	Students' oral presentation of assigned research topics on trace evidence & Review	

**List of Experiments**

	Labs	Topic
	1	Scientific measurement and experimental error
	2	Trace evidence collection and sorting

	3	Sample preparation for microscopic examination and use of the compound microscope
		Field trip to a shooting range for GSR collection
	4	Examination of human hair, and mammalian hair
	5	UFLC-MS/MS for organic GSR identification
	6	Examination of trace quantities of synthetic fibers
	7	SEM-EDX for GSR identification
	8	Paint/fiber analysis by Micro-FT-IR
	9	Pyrolysis-GC/MS for paint/polymer analysis

### **Attendance Policy**

Attendance is mandatory. In accordance with SHSU policy, attendance will be recorded each class period.

### **Blackboard**

The Course Home Page for CHM585 can be reached via: [blackboard.shsu.edu](http://blackboard.shsu.edu)  
 Login with your university username and password. You will be able to check your lab score, download literatures, and review lecture notes via Blackboard.

### **Classroom Rules of Conduct:**

Students are expected to assist in maintaining a classroom environment that is conducive to learning. Students are to treat faculty and students with respect. Students are to turn off all cell phones while in the classroom. Under no circumstances are cell phones or any electronic devices to be used or seen during times of examination.

### **Student Absences on Religious Holidays**

An institution of higher education shall excuse a student from attending classes or other required activities, including examinations, for the observance of a religious holy day, including travel for that purpose. A student whose absence is excused under this subsection may not be penalized for that absence and shall be allowed to take an examination or complete an assignment from which the student is excused within a reasonable time after the absence. A student who plans to miss a class or required activity to observe a religious holy day should inform the professor in writing prior to planned absence.

### **STUDENTS with Disabilities**

It is the policy of Sam Houston State University that no otherwise qualified disabled individual shall, solely by reason of his/her disability, be excluded from the participation in, be denied the benefits of, or be subjected to discrimination under any academic, Student Life program or activity. SHSU adheres to all applicable federal, state, and local laws, regulations, and guidelines with respect to providing reasonable accommodations for students with disabilities. If you have a disability that may affect adversely your work in this class, then I encourage you to register with the SHSU

Counseling Center and to talk with me about how I can best help you. Students with disabilities may request academic assistance when needed from a Committee for Continuing Academic Assistance for Disabled Students by visiting the director of the Counseling Center, located in the annex of the Lee Drain Building across the sidewalk from Farrington Building, or call (936) 294-1720 (For additional information see the University Catalog).

All disclosures of disabilities will be kept strictly confidential. Note that no accommodation can be made until you register with the Counseling Center.

### **Academic Honesty**

The Faculty Handbook states that the University expects all students to engage in all academic pursuits in a manner that is above reproach. Students are expected to maintain complete honesty and integrity in the academic experiences both in and out of the classroom. Any student found guilty of dishonesty in any phase of academic work will be subject to disciplinary action. Furthermore, the University and its official representatives may initiate disciplinary proceedings against a student accused of any form of academic dishonesty including, but not limited to, cheating on an examination or other academic work which is to be submitted, plagiarism, collusion and the abuse of resource materials.

### **Useful Links:**

Student Services Activities Calendar: <http://www.shsu.edu/calendar/>

Schedule of Classes: <http://www.shsu.edu/schedule/>

Academic calendar: <http://www.shsu.edu/catalog/calendar.html>

Blackboard: <http://blackboard.shsu.edu/>

Student Syllabus Guidelines: <http://www.shsu.edu/syllabus/>

### **Useful Reference:**

1. Trace Evidence Analysis – More Cases in Mute Witnesses, Editor: Max M. Houck, Elsevier, ISBN: 0-12-356761-0, 2004.
2. American Board of Criminalistics, [http://www.criminalistics.com/cert\\_fellow\\_traceevidence.cfm](http://www.criminalistics.com/cert_fellow_traceevidence.cfm)
3. Techniques of Crime Scene Investigation, Fisher, Barry A.J., A. Svensson, and O. Wendel, Fifth Edition., CRC Press, 1993.
4. Trace Evidence Recovery Guidelines, Forensic Science Communications, U.S. Department of Justice, Federal Bureau of Investigation , 1999, Volume 1 Number 3, <http://www.fbi.gov/hq/lab/fsc/backissu/oct1999/trace.htm>.
5. <http://www.microscopyu.com/articles/polarized/polarizedintro.html>
6. Forensic Hair Examination, Forensic Science Communications, U.S. Department of Justice, Federal Bureau of Investigation, 2005, Volume 7, Number 2, [http://www.fbi.gov/hq/lab/fsc/backissu/april2005/standards/2005\\_04\\_standard\\_s02.htm](http://www.fbi.gov/hq/lab/fsc/backissu/april2005/standards/2005_04_standard_s02.htm)
7. Burns, D. T.; Doolan, K. P., The automation of the acquisition and evaluation of pyrolysis-gas chromatography–mass spectrometry data for paint samples, Anal. Chim. Acta 2006, 571 (1), 25-29.