# Department of Chemistry Seminar Series
# Spring 2023

Friday, March 31, 2023, 3:30 PM – **HPA1-O119 (Health Sciences)**

## A Quantitative Approach towards Forensic Hair Examinations

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Hair is frequent trace evidence found in crime scenes due to its high transfer potential due to natural shed. They can provide investigative information in various cases, including homicide, sexual assault, missing persons, and human trafficking. Physical examination of hair involves the analysis of microscopic features, such as color and pigmentation, commonly using bright field microscopy. Microscopical techniques are non-destructive, with minimum to no sample preparation that can be followed by chemical and biological analysis. Although individualization is not possible via microscopical methods, it can be used to include or exclude potential donors. However, previous microscopical techniques lack quantitative and statistical approaches. This research uses quantitative and statistical approaches to evaluate the discrimination power microscopical examinations. The inter- and intra-sample variance of hair features is further explored. Statistical methods, such as analysis of variance (ANOVA), will be used to explore variables. Random Forest (RF) and Convolution Neural Networks (CNNs) will be used to discriminate between individuals. Additionally, the effect of hair dyes is explored. Non-destructive dye extraction methods were developed, and chemical analysis using Direct Analysis in Real Time Mass Spectrometry (DART-MS) was used. The chemical profile of the extracted dyes as compared to the original dye and dye extracts. Principal Component Analysis, Hierarchical Cluster Analysis (HCA), and Linear Discriminant Analysis are used to discriminate between hair dyes. Finally, changes in the measured features pre- and post-dying are compared. This project aims to increase the value of microscopical examination and develop non-destructive chemical analysis methods for hair dyes.