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Developing a Forensic Science Program for WPI

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by

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Abstract

This project examined the need for a forensic science program(s) at WPI and addressed how a competitive forensic science curriculum could be developed. A survey was used to determine the level of interest in a forensic science curriculum at WPI. Based on forensic science programs offered at other colleges and universities, a tentative program was developed for implementation at WPI. The project showed that a forensic science program is needed and will be beneficial to WPI and its students.

Introduction

The main goal of this IQP project was to develop a forensic science program(s) for WPI that may possibly be implemented in the future. It was also hoped that this project would be able to determine the interest in a forensic science program by surveying current WPI students. The intent of the project was to focus on all aspects necessary for the development, analysis and implementation of a forensic science program. The scope and size of the program will be determined based upon interest in the program and the feasibility of implementing it.

Forensics is an exciting, cutting edge field that is expanding throughout the world. As we step foot into the twenty-first century forensics has an ever-growing role in our lives. Forensic science is now the backbone of criminal investigations and has allowed justice to be served in many courts. As the need for trained forensic scientists increases there are still very few institutions that offer a forensic science curriculum. This is an area that WPI could get involved with and benefit from.

This project is highly beneficial to the WPI community in a multitude of ways. It will benefit the school by allowing it to expand its academic and research interests into another relevant and prosperous area of science and technology. Not many schools offer forensic science programs and if WPI was to have a carefully designed, competitive program, WPI could attract a large amount of students interested in studying forensics. In addition law enforcement agencies and private corporations with an interest in forensics would most likely be interested in either having personnel trained at WPI or working in conjunction with WPI in a forensic science program. Overall, it is believed

that this program would generate a greater interest in WPI and allow WPI to become a leader in another area of science and technology.

Another aim of the project was to research and learn from current forensic science offerings at other colleges and universities in addition to determing the actual interest in such programs here at WPI. By taking the information gained through the research, a forensic science program is developed following WPI guidelines for a degree program. It is hoped that by learning from the programs offered at other schools the newly designed program will be able to exceed them because it will incorporate their good aspects and improve upon them in order to develop a competitive program.

Background

The main source of reference for this project was literature from forensic science programs across the country. Using the American Academy of Forensic Science (AAFS) website[1], links to other schools that have forensic science programs were found. From here the web sites of colleges that offer forensics programs were found and literature from them was requested. The course catalogs from the various schools provided an idea as to the size, scope, and quality of their programs. This was the major source for background information on actual course offerings and they were used to help design the new curriculum in this project.

Various scientific journals were pursued for information regarding forensic science education and the demand for trained forensic scientists. For instance, the New England Association of Chemistry Teachers (NEACT) Journal offers an article that addresses forensic science education and requirements.[2] The article deals with the

various areas of study in forensics and the scope of the curriculum. The article also points to a lack of room in university programs for forensic science applicants. According to the article, "At the University of Illinois, there are typically over 100 applicants for 10-15 seats in the master's program." This illustrates the fact that WPI has the potential to become a leader in forensic science education if it were to establish a forensic science program.

Another article that offers insight into the need for forensic scientists at the regional level around WPI was found in the local newspaper.[3] The article gives insight into the backlog that is occurring in crime labs throughout the state of Massachusetts. The article then goes on to explain how the backlog is frustrating prosecutors because hundreds of cases are being dismissed every year because of the crime lab backlogs. This article demonstrates a clear need for additional people trained in the art of forensic science.

On the national level Chemical and Engineering News offers an article[4] about the need for chemists in the field of forensic analysis. The article goes on to mention that state and government laboratories are so backlogged with forensic analysis work, especially involving DNA, that private firms have begun to have opportunities to work in the field as well. There is too much work and the labs are becoming overwhelmed with the amount of DNA testing that is needed. This clearly illustrates that there is a demand for forensic chemists in our society.

Overall, there is a high demand for forensic scientists, at both the regional and national level, but not enough leading colleges and universities offering degrees in forensic science. WPI clearly has the academic reputation and commitment that could be

placed behind a forensic science program. Forensic science is an expanding field that is having a larger impact on our lives in the twenty-first century and it provides the opportunity for some very exciting, hands on research. Considering the current academic interests of WPI, forensic science would be a great addition to WPI, making it a leader in another exciting field.

Initial Steps/ Background Research

Initially, the project involved researching existing forensic science programs offered at other colleges and universities. Using the American Academy of Forensic Science (AAFS) website[1], links to other schools that have forensic science programs were found. From here information was requested from schools of interest. The intent was to find out about the programs' scope, curriculum, facilities, faculty and other important aspects.

The information given from the schools was used to gain an understanding of how most forensic science programs are organized and what they involve. After collecting literature from many schools, the information was then used as a model for the newly designed program. In addition, bits and pieces of programs from other schools were used in laying out the new program. By doing this, it is hoped that the new WPI program will cover most of the key aspects covered by other programs and therefore it will become very competitive.

Another key step was to find out requirements mandated by WPI that will affect the new program. For example, what are the necessary steps for proposing a new degree program and what are the regulations that govern it? Also, distribution requirements were determined and taken into account within the curriculum. Once all of the guidelines

for the establishment of the new degree program had been investigated, a preliminary design of the program(s) began.

Initial Program Design and Structure

Once the background research had been completed the project moved to the next phase, which was beginning to layout the basics of the program. The scope of the program was one of the first topics that were addressed. The type of degree(s) offered and the areas of concentration needed to be decided upon before the planning could move forward. Another area that had to be determined was the organizational structure of the program. For instance, it may be wise to have the forensic science curriculum be similar and work in conjunction with the WPI Department of Chemistry and Biochemistry because many of the core courses will be the same.

After determining the structure of the new department the next step was beginning to design the course sequence(s). The department will ultimately decide upon the distribution requirements for the newly developed degree. This will involve deciding what courses are required and which ones are electives. In addition a logical sequence will have to be developed keeping prerequisites in mind. The course sequence will most likely be similar to that of the Chemistry or Biology Departments', especially for the basic core courses. A tentative structure of the program will be addressed later in this report.

Summary and Results of the Survey

At the same time as the organization and offerings of a forensic science program were being investigated, a survey was being administered to a representative population of WPI students. In order to determine the potential interest in a forensic science program at WPI a survey was created. There were two separate surveys sent out to various WPI students at both the graduate and undergraduate levels. The surveys were e-mailed to chemistry, biochemistry, chemical engineering, physics, biology, bioengineering and fire protection majors. In order to easily analyze and potentially quantify the survey responses, the students were asked to answer the questions on a numerical scale of one to five. A copy of both of the surveys can be found in Appendix I.

Due to time constraints and a lack of graduate respondents, only the undergraduate survey will be analyzed and discussed from this point on. However, the raw data from the graduate survey can be viewed in the Appendices III and IV, respectively. The survey questions were e-mailed out to undergraduate students in the selected majors. The responses were e-mailed back to Professor Berka. Ultimately, responses to the undergraduate survey were received from 78 students and analyzed for the project.

Analysis of the Survey Results

In order to determine if there is enough interest in a forensic science program the results of the survey were carefully analyzed. Since the survey responses had been given on a numerical scale the averages, medians, and standard deviations of the responses to each question could be calculated. The responses were also broken down by percentages to determine if a large percentage of students had the same responses. In addition,

Pearson correlation coefficients were calculated between various questions. These show correlations between the responses to various questions.

In order to thoroughly present the data analysis, each question will be stated separately along with its corresponding statistical information based upon the responses. There was a total of seventy-eight undergraduate respondents with a median graduation year of 2005, but a few omitted responses. The questions asked in the survey and the analysis of the responses follows.

1. *How would you rate your knowledge of forensic science and its applications to society?*

Not knowledgeable - 1 2 3 4 5 - Very knowledgeable

For question #1 the average response was a 3.03, the median was 3.00 and the standard deviation of the data was 1.10. In addition 37.66% of the respondents answered with either a "4" or a "5", indicating that they believed that they were very knowledgeable of forensic science. A total of 31.17% of the students answered the question with a "1" or "2", indicating that they were not knowledgeable in forensic science.

2. *Would you be interested in learning more about career opportunities in forensic science?*

Not interested - 1 2 3 4 5 - Very interested

For question #2 the average response was a 4.08, the median was 4.00 and the standard deviation of the data was 1.18. In addition 76.62% of the respondents answered with either a "4" or a "5", indicating that they would be highly interested in learning more about career opportunities in forensic science.

3. *Are you currently pleased with and interested in the major you have selected?*

Not pleased - 1 2 3 4 5 - Very pleased

For question #3 the average response was a 4.03, the median was 4.00 and the standard deviation of the data was 0.89. In addition 76.62% of the respondents answered with either a "4" or a "5", indicating that they are currently pleased with and interested in the major they have selected.

4. *Would you have an interest in taking a course in forensic science at WPI?*

Not interested - 1 2 3 4 5 - Very interested

For question #4 the average response was a 4.43, the median was 5.00 and the standard deviation of the data was 0.91. In addition 85.71% of the respondents answered with either a "4" or a "5", indicating that they would be highly interested in taking a course in forensic science at WPI.

5. *If forensic science courses were offered in the evening at WPI, would you have a problem taking such courses?*

No Problem - 1 2 3 4 5 – Impossible

For question #5 the average response was a 2.39, the median was 2.00 and the standard deviation of the data was 1.24. In addition 51.91% of the respondents answered with either a "1" or a "2", indicating that they would have little or no problems with taking forensic science courses in the evening at WPI.

6. *Would you be interested in completing a concentration in forensic science at WPI?*

Not interested - 1 2 3 4 5 - Very interested

For question #6 the average response was a 3.59, the median was 4.00 and the standard deviation of the data was 1.39. In addition 60.53% of the respondents answered with either a "4" or a "5", indicating that they would be highly interested in completing a concentration in forensic science at WPI.

7. *Would you be interested in obtaining a bachelor's degree in forensic science?*

Not interested - 1 2 3 4 5 - Very interested

For question #7 the average response was a 2.99, the median was 3.00 and the standard deviation of the data was 1.38. In addition 38.96% of the respondents answered with either a "4" or a "5", indicating that they would be highly interested in obtaining a bachelor's degree in forensic science. A total of 32.47% of the students answered the question with a "1" or "2", indicating that they were not very interested in obtaining a bachelor's degree in forensic science.

8. *If a bachelor's degree program in forensic science had been offered when you first applied to WPI, would you have been interested in enrolling in it at the time?*

Not interested - 1 2 3 4 5 - Very interested

For question #8 the average response was a 3.20, the median was 3.00 and the standard deviation of the data was 1.47. In addition 46.75% of the respondents answered with either a "4" or a "5", indicating that they would have been highly interested in enrolling in a bachelor's degree program in forensic science if it had been offered when they first applied to WPI. A total of 32.47% of the students answered the question with a "1" or "2", indicating that they would not have been very interested in enrolling in a bachelor's degree program in forensic science if it had been offered when they first applied to WPI.

9. *Once you graduate from WPI with a bachelor's degree, would you be interested in enrolling in a master's degree program in forensic*

science?

Not interested - 1 2 3 4 5 - Very interested

For question #9 the average response was a 3.18, the median was 3.25 and the standard deviation of the data was 1.47. In addition 48.68% of the respondents answered with either a "4" or a "5", indicating that they would be highly interested in enrolling in a master's degree program in forensic science after receiving their bachelors degree. A total of 34.21% of the students answered the question with a "1" or "2", indicating that they would not be very interested in enrolling in a master's degree program in forensic science after receiving their bachelor's degree.

A summary of the analyses stated above is given below in Tables #1 and #2. Table #1 gives the number of responses, the average and median responses and the standard deviation of the responses for each of the undergraduate questions. Table #2 gives the percentage of respondents that gave a given answer. The table also includes the sum of the respondents who gave either "1 or 2" or "4 or 5" as their responses. Those statistics were used in a lot of the conclusions that were made about interest in forensic science.

Table #1

Statistical Analysis Data for The Undergraduate Survey

Major	Grad Yr	Q1	Q2	Q 3	Q 4	Q 5	Q 6	Q 7	Q 8	Q 9
Number	78	77	77	77	77	77	76	77	77	76
Average		3.03	4.08	4.03	4.43	2.39	3.59	2.99	3.20	3.18
Std Dev		1.10	1.18	0.89	0.91	1.24	1.39	1.38	1.47	1.47
Median	2005	3.00	4.00	4.00	5.00	2.00	4.00	3.00	3.00	3.25

Table #2

Percentages Analysis of the Responses to Individual Questions

Response	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9
# 5	6.49	49.35	32.47	63.64	7.79	34.21	15.58	25.97	23.68
# 4	31.17	27.27	44.16	22.08	7.79	26.32	23.38	20.78	25.00
# 3.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.32
# 3	31.17	10.39	18.18	9.09	32.47	17.11	28.57	19.48	15.79
# 2.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.30	0.00
# 2	20.78	7.79	3.90	3.90	19.48	9.21	9.09	12.99	13.16
# 1	10.39	5.19	1.30	1.30	32.47	13.16	23.38	19.48	21.05
TOT	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
#4 and #5	37.66	76.62	76.62	85.71	15.58	60.53	38.96	46.75	48.68
#1 and #2	31.17	12.99	5.19	5.19	51.95	22.37	32.47	32.47	34.21

Pearson correlation coefficients calculated using Excel were used to look for correlations between the responses of various questions. For example, a correlation coefficient was determined for all of the responses to question #1 compared to all of the responses to question #2. Some questions were relatively unrelated to others; therefore there was little or no correlation. This was expected for a situation such as this where the questions on the survey were not necessarily expected to correlate, since each question is dependent on the respondent's opinions rather than the other survey questions. For instance, question #3 asks if the student is pleased with their current choice of major. This question seems to have no correlation to their potential interest in forensic science. On the other hand, questions such as #2, 4, 6, 7, 8 and 9 all seemed to have the largest correlations with one another and these were the questions that truly asked the student what their level of interest in forensics is. The correlation results are shown in Table #3 and the correlations between questions were also plotted on standardized 3-D bar graphs (Figures #1-9) that are given in the Appendix IV.

Table #3

Correlation Coefficients Between Questions

Questions	r - value	Questions	r - value	Questions	r - value	Questions	r - value
q1-q2	0.3537	q2-q4	0.7297	q3-q7	-0.0748	q5-q7	-0.3435
q1-q3	-0.0007	q2-q5	-0.3731	q3-q8	-0.0900	q5-q8	-0.3161
q1-q4	0.4228	q2-q6	0.7402	q3-q9	-0.0987	q5-q9	-0.4014
q1-q5	-0.0752	q2-q7	0.6878	q4-q5	-0.3726	q6-q7	0.8545
q1-q6	0.4137	q2-q8	0.6196	q4-q6	0.7058	q6-q8	0.7122
q1-q7	0.3986	q2-q9	0.7630	q4-q7	0.6120	q6-q9	0.7711
q1-q8	0.2825	q3-q4	0.0349	q4-q8	0.5615	q7-q8	0.7361
q1-q9	0.3682	q3-q5	0.0386	q4-q9	0.6324	q7-q9	0.7333
q2-q3	-0.0145	q3-q6	-0.0281	q5-q6	-0.4110	q8-q9	0.7495

The greatest correlation between any two questions occurs between questions #6 and #7. The correlation coefficient is 0.8545, which means there is a strong correlation between a student's desire to obtain a concentration in forensic science and the students desire to obtain a bachelors degree in forensic science. Also, in general questions #6-9 all seem to correlate quite well with one another. They all have correlation coefficients great than 0.7 which means they tend to be related. All of these questions address the student's interest in a concentration, bachelor's or master's degree in forensic science. This means that one could assume that the students have a very strong desire to obtain some type of an education in forensic science. This assumption can be made because there is a large percentage of students interested in the pursuit of the forensic science education mentioned in each of the questions and because the correlation between each of the questions is relatively high.

The questions that most display the students' interest in a forensic science program are #2 and #4 and #6-9. Question #2 asks: "Would you be interested in learning more about career opportunities in forensic science?". The average response to the question on a scale of 1 to 5 was a 4.08, with 5 meaning "very interested". In addition a

total of thirty-eight students responded with a 5 meaning they are very interested in finding out more about career opportunities in forensic science.

Question #4 asks: "Would you have an interest in taking a course in forensic science at WPI?". The average response to the question on a scale of 1 to 5 was a 4.43, with 5 meaning "very interested". In addition, 85.71% (or sixty-six out of the seventy-seven) of the students survey responded with a "4" or "5" meaning they are highly interested in taking a course in forensic science.

Question #6 asks about a student's interest in completing a concentration in forensic science. A total of 60.53% (or forty-six out of seventy-six) respondents were highly interested in completing a concentration in forensics. This shows that well over half of the people surveyed would strongly consider a concentration in forensic science if it were offered at WPI.

Discussion of the Survey Results

Overall, the survey shows a very strong interest in a forensic science curriculum at WPI. This statement in justified by the fact that such a high percentage of students responded with high level of interest to questions #2, #4 and #6-9. For instance, on question #4 when 85.71% of the students surveyed are highly interested in taking a course in forensic science, this is a good indication that there is enough interest to make such courses viable and successful at WPI.

Percentage analysis of responses has and will be used to draw a large amount of the conclusions from this survey. The reason for this is that other methods, such as looking at the averages and medians did not seem to accurately represent the responses to

the survey. Some students were tremendously interested in all aspects of a forensic science program, while others responded that they have little or no interest in forensic science. Therefore, looking at average and medians didn't seem to properly represent the large percentages of students who are truly interested in forensic science.

Similarly, question #6 had a large percentage (60.53%) of students who are highly interested in completing a concentration in forensics. With this large a percentage of the respondents being highly interested in a concentration, this seems to suggest that a forensic science concentration is wanted and needed at WPI. Overall, the survey seems to suggest that there is interest in forensic science on the WPI campus. The survey only represents a small part of the WPI community, but assuming that it is a representative survey, it demonstrates the need for a forensic science program.

Questions #7-9 also seemed to have a significant amount of highly favorable responses. For instance on questions #8 and #9 nearly half of the responses were 4's or 5's. The responses to question #8 indicate that many students would have been interested in being involved in an undergraduate forensic science program at WPI. The responses to question #9 indicate that almost half of the students would strongly consider obtaining a masters degree in forensics.

Overall, the results of the survey seem to indicate a reasonably strong interest in forensic science among the current WPI student body. Therefore, the survey results seem to justify further pursuit of the development of a forensic science program at WPI. This is justified by the fact that over 85% of the students surveyed would be interested in taking a course in forensic science. There were also several other facts and figures

discussed above that show that there would be enough interest in a forensic science program to make it a viable and successful addition to the WPI curriculum.

Possible Structure of a Forensic Science Program for WPI

After looking at the curriculums offered at other prominent schools that offer forensic science, an initial program structure for WPI began to come together. Some of the schools that were looked at include the University of New Haven, Baylor University, Pace University, Russell Sage College, the University of Mississippi, the John Jay College of Criminal Justice and the University of Central Florida. After looking at the offerings of these colleges and universities it became clear that there were several common threads that ran through all of the programs. A few examples of the specific curricula of some of these schools can be found in the appendices.

These reoccurring themes lead to the development of a list of very common courses. These courses seemed to be in almost every school's curriculum and seem to be essential to the pursuit of a forensic science education. The list of "recommended courses" contained common courses that are already offered at WPI in its various departments. It was also noted that the core courses of a forensic science curriculum are very similar to the core courses that are already found within the WPI Chemistry and Biochemistry Department. Using this information a list of existing WPI courses that would be considered "recommended courses" for a forensic science program was developed. The list includes the major projects that are an integral part of the WPI education as well as the courses that will provide a student with the necessary educational

background to move in to more advanced forensics courses. The list that was developed is as follows:

Recommended Courses For A WPI Forensics Program

- General Chemistry (CH 1010, 1020, 1030, 1040)
- Organic Chemistry (CH 2310, 2320)
- Biochemistry (CH 4110, 4120)
- Instrumental Analysis (CH2640)
- Intro. to Biology (BB 1001)
- Basic Calculus (MA 1021, 1022)
- Physics (PH 1110, 1120)
- Statistics (MA 2611)
- Genetics (BB 2920)
- Microscopy (BB 3521)
- Molecular Biology (BB 3518)
- MQP (1 unit)

Total Credits: 7 units

More detailed descriptions of the courses can be found in Appendix V. The list covers the basic math and science necessary for any current day scientist as well as more specialized courses such as biochemistry, genetics, instrumental analysis and microscopy which will prove to be useful to any forensic scientist. Also, as is standard, the curriculum would require that the student complete an MQP project. Note that all of

these courses are already offered by the university and would require no additional effort or costs to extend these classes to students involved in a forensic science program. A detailed description, taken from the WPI course catalog, of each of these courses can be found in the appendices. The proposed "recommended courses" would account for 7 units of the student's degree requirements.

The rest of the forensic science distribution requirements would be comprised of forensic science courses that would be developed and instituted, electives and other projects. A list of potential forensic science courses was developed based on the course offerings at other colleges and universities. The course titles are listed below and a brief introduction to the material covered in the courses can be found in Appendix VII.

Potential Forensic Courses That Could Be Offered

- Introduction to Criminal Justice
- Criminal Law
- Principles of Criminal Investigation
- Forensic Photography with Laboratory
- Introduction to Forensic Science
- Criminal Procedure I
- Fingerprints with Laboratory
- Scientific Methods in Human Services
- Forensic Science Laboratory I & II
- Criminology
- Advanced Forensic Science I & II with Laboratory

- Victimology
- Seminar on Forensic Science
- Death Investigation—Scene to Court
- Internet Investigations and Audit-Based Computer Forensics
- Practical Issues in Cryptography
- Computer Applications in Research and Program Evaluation
- Crime Mapping and Analysis
- Domestic and Sexual Violence
- Law and Evidence
- Research Methods and Statistics in Criminal Justice
- Survey of Forensic Science
- Advanced Crime Scene Investigation
- Advanced Criminalistics I & II and Laboratory
- Advanced Investigation I & II
- Drug Chemistry and Identification
- Fire Scene Investigation and Arson Analysis
- Death Investigation- Scene to Court
- Physical Analysis in Forensic Science
- Physical Analysis in Forensic Science Laboratory
- Forensic Microscopy
- Medicolegal Investigation and Identification
- Forensic Toxicology
- Advanced Forensic Serology I & II

- Contemporary Issues in Investigation
- Biomedical Methods in Forensic Science
- Fire/Accident Scene Reconstruction

The above list of courses is quite long and as a result only a sampling of the above courses could initially be offered. Also, some of these courses may be considered to be graduate level courses. As a result, they may not be offered unless a graduate program is instituted.

The list of forensics courses was further broken down into essential forensic science courses that would become part of the distribution requirements for students. The exact details of the distribution requirements are very flexible because this is a very preliminary look into the development of a course sequence. A list of 12 course (4 units) was developed.

"Core Forensics Courses"

- Introduction to Criminal Justice
- Introduction to Forensic Science
- Principles of Criminal Investigation
- Fingerprints with Laboratory
- Forensic Science Laboratory
- Criminology
- Advanced Forensic Science with Laboratory
- Physical Analysis in Forensic Science

- Forensic Microscopy
- Crime Mapping and Analysis
- Advanced Crime Scene Investigation
- Advanced Criminalistics

The above courses are courses that are essential to a forensic science education. These courses will give an introduction to forensic science in general. If the students wish, they can choose to take the more specialized courses as electives.

The students will also have to complete a Sufficiency and IQP while at WPI. These are of minimal concern when establishing the forensic science program since these projects will be conducted independently of the forensic science department. The projects will also not be a part of the student's Forensic Science Distribution Requirements because they do not have to be related to their forensic science education. However, if the student wishes they may complete these projects on topics in forensic science. Such areas include, but are not limited to, the history of forensics, impacts of forensic science on society, and examining the ever-growing role of forensic science.

A preliminary list of Forensic Science Distribution Requirements for undergraduate students was developed. It consists of a minimum of 9 units of course work plus the MQP. This will still leave the student 6 units worth of classes for electives and meeting IQP, Sufficiency and social science requirements. The requirements ensure that the student will have a solid educational base in math, basic science and forensic science. The mandatory courses will also provide initial knowledge that will be needed in the more advanced forensic science courses. After completing the distribution requirements, a student will be free to pursue specific areas of forensic science such as

fingerprinting, serology, toxicology, arson, or other areas of forensics. The proposed requirements are as follows.

Proposed Distribution Requirements for Forensic Science Majors

Requirements	**Minimum Units**
1. Mathematics and Basic Science (See note #1)	1 2/3
2. Chemistry (See note #2)	2
3. Biology (See note #3)	2/3
4. Forensic Science (See note #4)	3
5. Additional Science/ Engineering (See note #5)	2 2/3
	Total: 10 units

Notes

1. Must include differential and integral calculus and at least 2/3 of a unit of physics.
2. Must be above the level of general chemistry (2000 level or higher). Must include 2/3 unit of organic chemistry, 1/3 unit of analytical chemistry, and 2/3 units of biochemistry.
3. From among BB (2920, 3518, 3521).
4. Must include Intro. to Forensic Science and Intro. to Criminal Justice.
5. Distributed among the MQP, the natural and physical sciences, computer science, mathematics, and engineering (and including general chemistry, CH1010-1040).

Comments on the Program and Plans for Implementation

The above outlined course structures are preliminary programs that are based on the structure of programs in operation at other colleges and universities. The amount of forensic science courses offered at WPI would be very flexible and based on a variety of issues. Obviously, it would be difficult to instantaneously offer all of the courses listed above. As a result, it would be wise to initially offer only the most elementary forensic science courses. This would allow for a gradual, yet determined, development of a forensic science department at WPI. During the first couple of years of the department it may be wise to also only offer forensic science as a concentration.

There are many benefits to this approach. First of all, it would reduce the costs of starting the department. Only a few faculty members would be needed and only minimal laboratory space and supplies would be needed upon initial implementation. In addition, it would give time to see how well the courses have been implemented and survey the interest in the programs among the students.

If the initial implementation of forensic science is successful then it would be advisable to hire additional faculty, add more laboratories and equipment and most importantly, offer a wider variety of forensic science courses. At this point, the Forensic Science Department will begin to grow and become increasingly successful. Now the department would be in a position to offer undergraduate and possibly graduate degrees in forensic science. WPI would also now be able to rival the other schools that provide forensic science education.

WPI may also want to seek out affiliations of mutual benefit to aid the newly developed department. For instance, have WPI faculty work in conjunction with local police and fire officials on forensic science topics. Perhaps, some of the crime lab employees could become adjunct faculty. The affiliations would also allow for outside funding that would lead to forensics research of mutual benefit.

Summary and Conclusions

Overall, the survey revealed that there is enough interest among WPI students to warrant a forensic science curriculum at WPI. The majority of the undergraduates surveyed would be interested in taking a course in forensic science. In addition, if the program were to be established, it would attract more prospective students, who are interested in forensics, to WPI.

Given the growing role of forensic science in society and the demand for forensic scientists, there is a need for more forensic science degree programs. Very few colleges and universities offer degrees in forensics, yet the demand for trained forensic scientists in increasing greatly, with no end in sight. There are very few schools in the Northeast that offer forensics programs. Also, media coverage, movies and TV series portraying forensic science have also dramatically increased the interest in forensic science.

All of this information seems to point to the fact that more forensic science programs need to be instituted at colleges and universities throughout the county. Since WPI is already a leader in science and technology in the Northeast, it would be an ideal school to become a major figure in forensic science education. This would be a beneficial and profitable endeavor for WPI.

If WPI, were to begin to develop a forensic science curriculum it would be advised to initially implement a few, basic courses in forensic science. If these courses are successful, then more advanced courses could be offered and the Forensic Science Department could be expanded to the point where WPI can offer a forensic science concentration. Ultimately, as funding and interest increase a bachelor's and master's program become possible. Given the current need for trained forensic scientists, there is a strong possibility that a forensic science degree program would become extremely lucrative at WPI.

In order for WPI to keep up with emerging science and technology it will eventually become necessary for WPI to explore the possibility of implementing forensic science curricula. Given the current demand, the sooner WPI takes action the better. WPI could become a prominent forensic science research institution. A forensic science program would increase enrollment at WPI in addition to exposure of its students to new areas of applied science. This is a very feasible issue that WPI needs to seriously consider.

Appendices

Appendix I- Copies of the Undergraduate and Graduate Surveys

Undergraduate Survey:

Hello - My name is Brian Elolampi, CM 04. In working on an IQP project with Prof. Berka, I have prepared the following survey to determine the amount of interest in a forensic science curriculum by undergraduates at WPI. Forensic science is a broad field that includes DNA technologies, toxicology, forensic medicine and dentistry, ballistics, arson and explosives, digital image processing, crime scene and death investigation, microscopy, legal and ethical issues and other forensic areas.

Your responses to this survey will be kept confidential. The results will only be used to determine the interest in forensic science at WPI. Thank you in advance for filling out this survey.

The survey consists of a series of questions and you should give your responses on a scale from 1 to 5. For instance, if 1 means not interested at all and 5 means very interested, pick one number from 1 to 5 that best describes your level of interest in the issue addressed in the question. Simply type the number of your response on the line indicated under each question. When you have completed the survey, please e-mail the completed survey to lhberka@wpi.edu. Your cooperation is greatly appreciated!

Brian and Prof. Berka

Current Major: Expected Graduation Year:

1. How would you rate your knowledge of forensic science and its applications to society?

   Not knowledgeable - 1 2 3 4 5 - Very knowledgeable

   Response:

2. Would you be interested in learning more about career opportunities in forensic science?

   Not interested - 1 2 3 4 5 - Very interested

   Response:

3. Are you currently pleased with and interested in the major you have selected?

   Not pleased - 1 2 3 4 5 - Very pleased

Response:

4. Would you have an interest in taking a course in forensic science at WPI?
   Not interested - 1 2 3 4 5 - Very interested

   Response:

5. If forensic science courses were offered in the evening at WPI, would you have a problem taking such courses?
   science at WPI?
   No problem - 1 2 3 4 5 - Impossible

   Response:

6. Would you be interested in completing a concentration in forensic science at WPI?
   Not interested - 1 2 3 4 5 – Very interested

   Response:

7. Would you be interested in obtaining a bachelor's degree in forensic science?
   Not interested - 1 2 3 4 5 - Very interested

   Response:

8. If a bachelor's degree program in forensic science had been offered when you first applied to WPI, would you have been interested in enrolling in it at the time?
   Not interested - 1 2 3 4 5 - Very interested

   Response:

9. Once you graduate from WPI with a bachelor's degree, would you be interested in enrolling in a master's degree program in forensic science?
   Not interested - 1 2 3 4 5 - Very interested

   Response:

Graduate Survey:

Hello - My name is Brian Elolampi, CM 04. In working on an IQP project with Prof. Berka, I have prepared the following survey to determine the amount of interest in a forensic science curriculum by graduate students at WPI. Forensic science is a broad field that includes DNA technologies, toxicology, forensic medicine and dentistry, ballistics, arson and explosives, digital image processing, crime scene and death investigation, microscopy, legal and ethical issues and other forensic areas.

Your responses to this survey will be kept confidential. The results will only be used to determine the interest in forensic science at WPI. Thank you in advance for filling out this survey.

The survey consists of a series of questions and you should give your responses on a scale from 1 to 5. For instance, if 1 means not interested at all and 5 means very interested, pick a number between 1 and 5 that best describes your level of interest in the issue addressed in the question. Simply type the number of your response on the line indicated under each question. Any additional comments you wish to make can be added to the end of the survey. When the you have completed the survey, please e-mail the survey to lhberka@wpi.edu. Your cooperation is greatly appreciated!

Brian and Prof. Berka

Current Major: Expected Graduation Year:
Level of Degree (MS or PhD):

1. How would you rate your knowledge of forensic science and its applications to society?
   Not knowledgeable - 1 2 3 4 5 - Very knowledgeable

   Response:

2. Would you be interested in learning more about career opportunities in forensic science?
   Not interested - 1 2 3 4 5 - Very interested

   Response:

3. Are you currently pleased with and interested in the major you have selected?
   Not pleased - 1 2 3 4 5 - Very pleased

   Response:

4. Would you have an interest in taking a course in forensic science at WPI?

Not interested - 1 2 3 4 5 - Very interested

Response:

5. If forensic science courses were offered in the evening at WPI, would you have a problem taking such courses?
science at WPI?

No problem - 1 2 3 4 5 – Impossible

Response:

6. Would you be interested in obtaining a master's degree in forensic science at WPI?

Not interested - 1 2 3 4 5 - Very interested

Response:

7. If a master's degree program in forensic science had offered when you first applied to WPI, would you have been interested in being enrolling in it at the time?

Not interested - 1 2 3 4 5 - Very interested

Response:

Appendix II- Raw Survey Data
Table #4 Undergarduate Survey Results

#	Major	Grad Yr	Q1	Q2	Q 3	Q 4	Q 5	Q 6	Q 7	Q 8	Q 9
1	BC	2005	4	5	4	5	2	5	4	5	4
2	ME/ FPE	2004	4	5	5	5	3	4	3	4	
3	BC	2005	4	5	4	5	1	5	4	2	5
4	BC	2005	3	5	3	5	2	4	4	4	3.5
5	BC	2006	2	2	4	4	3	2	1	1	1
6	CM	2006	1	3	4	2	5	2	1	1	1
7	CH	2006	2	5	5	5	2	4	3	3	4
8	FPE	2004	1	4	5	4	2	1	1	1	1
9	CM	2005	3	4	4	5	1	5	3	4	4
10	ME/ FPE	2006	1	5	4	5	1	4	4	5	5
11	BC	2005	4	4	3	5	3	3	3	4	2
12	PH	2003	1	1	5	3	3	1	1	2.5	1
13	BME	2003	4	5	5	5	1	5	4	4	5
14	BC	2004	3	4	4	5	1	4	2	2	4
15	BME	2004	4	4	4	5	3	4	3	5	3
16	BE/ PREMED	2004	3	4	4	5	2	5	5	3	4
17	BE	2005	2	5	3	5	3	4	3	5	5
18	BC	2003	5	5	5	5	1	5	5	5	5
19	CM	2005	3	2	5	4	3	3	1	2	2
20	CM	2003	2	3	4	2	3	1	1	2	1
21	CM	2005	4	5	1	5	1	5	3	4	5
22	BT	2004	4	5	4	5	1	4	3	3	4
23	BE	2005	3	5	4	5	4	3	3	3	4
24	CM	2003	4	5	3	5	1	5	5	5	4
25	BT/ IS	2004	2	4	4	4	4	4	3	2	3
26	CM	2006	3	4	3	4	1	3	3	3	3
27	BBT	2003	3	4	5	4	2	4	2	3	2
28	BC	2004	3	4	3	4	1	5	3	3	4
29	CM	2004	3	1	4	1	5	1	1	1	1
30	CM/ FPE	2004	4	5	3	5	2	5	4	4	5
31	BC	2005	5	5	4	5	1	5	5	5	5
32	CH	2004	1	2	4	4	3	1	1	1	1
33	CM	2005	4	5	3	5	2	3	3	1	3
34	BT	2004	3	3	5	4	3	3	3	2	3
35	CM	2005	2	4	5	5	1	5	3	5	3
36	CM	2005	2	3	3	3	4	3	2	3	2

Appendix II- Raw Survey Data
Table #4 Undergarduate Survey Results

#	Major	Grad Yr	Q1	Q2	Q 3	Q 4	Q 5	Q 6	Q 7	Q 8	Q 9
37	BC	2006									
38	BC	2006	3	5	5	5	2	5	4	5	5
39	BBT/ TSPC	2004	4	3	4	5	3	2	2	5	3
40	BC	2005	2	3	5	5	3	3	2	2	1
41	CM	2005	3	2	4	3	3	2	1	2	1
42	BE	2003	3	4	4	5	2	3	1	3	3
43	BBT	2003	4	5	5	5	1	3	1	1	1
44	ME/ FPE	2006	3	5	5	5	3	4	2	3	4
45	CM	2003	4	5	3	5	5	5	5	5	4
46	BB	2003	3	1	2	4	1	1	1	1	1
47	BT	2005	4	5	4	5	3	5	4	4	5
48	BC	2003	2	5	4	5	1	5	4	5	5
49	ME	2006	3	5	5	5	2	4	3	4	5
50	BE	2006	2	4	4	4	5	2	1	1	1
51	CM	2004	2	1	4	3	5	1	1	1	1
52	CH	2006	4	5	3	5	1	5	5	5	5
53	CH	2005	3	4	4	5	4	4	3	4	2
54	CM	2006	1	4	4	3	1	2	1	2	2
55	BC	2003	3	5	3	5	3	3	3	3	3
56	BC	2004	1	5	2	5	1	5	5	5	5
57	FPE		3	5	4	5	2	5	5	5	4
58	BME	2005	4	3	4	4	4	5	3	1	2
59	CM	2004	5	5	5	5	1	5	5	5	5
60	CH	2003	3	4	4	4	2	4	4	4	4
61	BC	2006	2	5	5	4	1	4	4	4	4
62	CM	2004	3	2	2	2	3	1	1	1	1
63	BBT	2005									
64	BBT	2004	4	5	5	5	1	4	3	3	4
65	BC	2005	2	4	4	3	2	2	3	3	2
66	BME	2006	1	4	5	4	3	4	4	4	4
67	CM	2006	5	5	5	5	3	5	5	3	2
68	FPE	2005	5	4	5	4	5	1	1	1	4
69	BB/ CH	2004	4	3	5	5	3		4	1	1
70	BBT	2004	3	4	5	5	3	4	4	4	3
71	BME	2005	4	4	4	4	3	4	4	5	3
72	BC	2003	2	5	3	5	2	4	4	4	4

Appendix II- Raw Survey Data
Table #4 Undergarduate Survey Results

#	Major	Grad Yr	Q1	Q2	Q 3	Q 4	Q 5	Q 6	Q 7	Q 8	Q 9
73	BE	2005	3	5	4	5	4	3	3	3	4
74	BE	2004	4	5	4	5	3	3	2	4	3
75	CM	2005	2	5	4	5	1	5	4	2	2
76	BME	2005	2	2	5	3	1	1	1	1	1
77	CM	2006	4	5	3	5	3	5	5	5	5
78	BIO	2006	4	5	5	5	1	5	5	5	5
79	BC	2004	4	5	4	5	3	5	4	5	5
	Number	**78**	**77**	**77**	**77**	**77**	**77**	**76**	**77**	**77**	**76**
	Average		**3.03**	**4.08**	**4.03**	**4.43**	**2.39**	**3.59**	**2.99**	**3.20**	**3.18**
	Std Dev		**1.10**	**1.18**	**0.89**	**0.91**	**1.24**	**1.39**	**1.38**	**1.47**	**1.47**
	Median	**2005**	**3.00**	**4.00**	**4.00**	**5.00**	**2.00**	**4.00**	**3.00**	**3.00**	**3.25**

Graduate Survey:

Table #5

Major	YOG	Q #1	Q #2	Q #3	Q #4	Q #5	Q #6	Q #7
FPE	Dec-02	3	5	4	5	2	5	5
FPE	2005 PT	2	5	5	5	5	4	4
ME/ FPE	2003	5	5	5	5	1	3	3
FPE	2003	2	5	5	4	2	4	4
CM	2003	3	4	5	4	1	2	2
BBT	2003	4	2	5	3	2	1	1
FPE	2002	3	4	5	4	2	3	4
FPE		3	5	3	5	1	3	3
CH	2002	4	5	5	5	2	2	3
FPE	2003	4	5	4	5	1	4	3
FPE	2005	5	4	5	4	5	3	1
BB/ CH	2004	4						
FPE	2003	1	1	5	3	5	4	2
CM PHD	2005	3	3	5	2	5	1	2
CH PHD	2005	2	4	3	4	1	3	3
CH	2005	2	4	3	4	1	3	3
CH	2005	2	4	3	4	1	3	3
FPE PT	2006	1	5	5	5	5	3	3
BIO	2003	3	4	3	3	3	3	2
CH PHD	2005	3	1	5	1	2	1	2
CH PHD	2003	5	5	4	5	1	5	5
Average		**3.05**	**4.00**	**4.35**	**4.00**	**2.40**	**3.00**	**2.90**
Median	**2003**	**3.00**	**4.00**	**5.00**	**4.00**	**2.00**	**3.00**	**3.00**

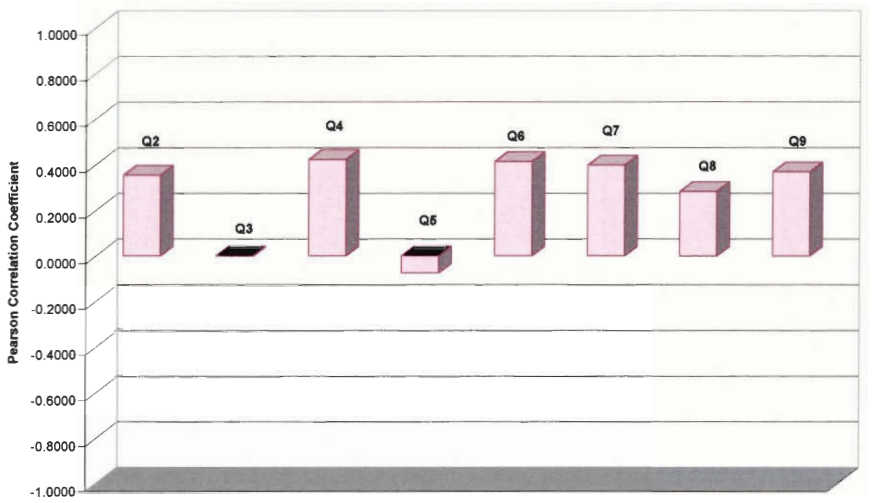
Appendix III- Additional Undergraduate Analysis of Responses

Table #6

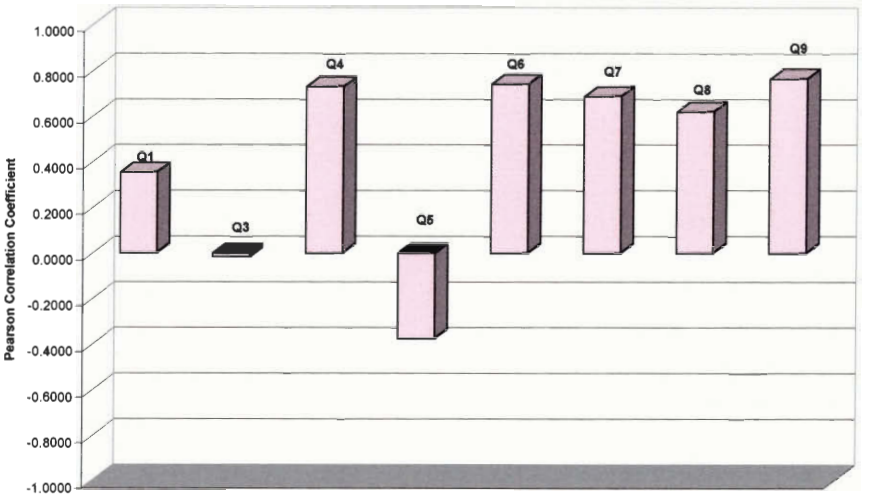
Major	# of Surveys		YOG	Q #1	Q #2	Q #3	Q #4	Q #5	Q #6	Q #7	Q #8	Q #9
		Average		3.00	4.11	4.07	4.44	2.43	3.55	2.98	3.18	3.15
Overall	87	Median	2005	3	5	4	5	3	4	3	3	3
		Average		3.00	4.50	3.89	4.72	1.89	4.11	3.61	3.72	3.75
Bio Chem	19	Median	2005	3	5	4	5	2	5	4	4	4
		Average		2.57	3.71	4.14	4.57	2.57	3.33	3.14	2.86	2.71
Chem	7	Median	2004	3	4	4	5	3	4	3	3	2
		Average		3.62	4.00	4.46	4.69	2.23	3.67	3.08	2.85	2.85
Bio	14	Median	2004	4	4	5	5	3	4	3	3	3
		Average		3.04	3.79	3.67	3.96	2.54	3.38	2.75	2.96	2.75
CM	24	Median	2005	3	4	4	5	3	3	3	3	3
		Average		3.00	4.15	4.15	4.54	2.92	3.54	2.85	3.23	3.23
BE	13	Median	2005	3	4	4	5	3	4	3	3	3
		Average		3.12	4.12	4.13	4.75	2.62	3.75	3.14	3.16	2.98
Other	10	Median	2005	3	4	4	5	3	4	3	3	3

Plots of Correlation Coefficients for Questions #1-4 Compared With All Other Questions

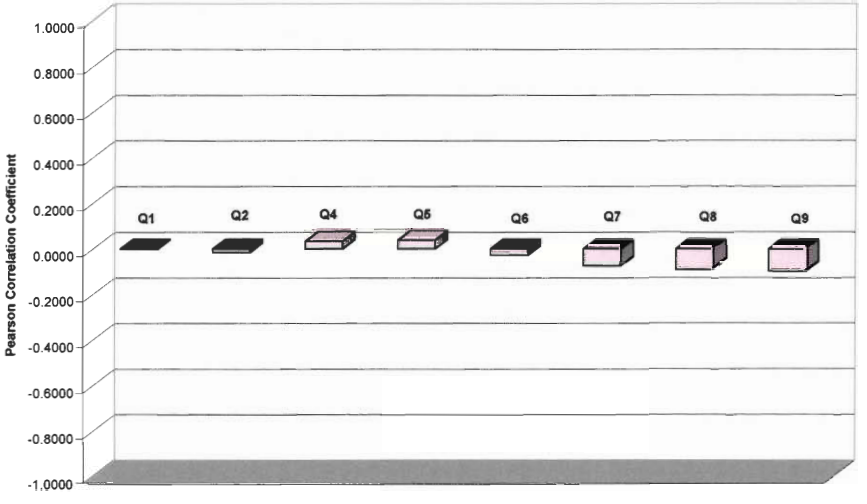
Correlation of Questions #2-9 With Question #1



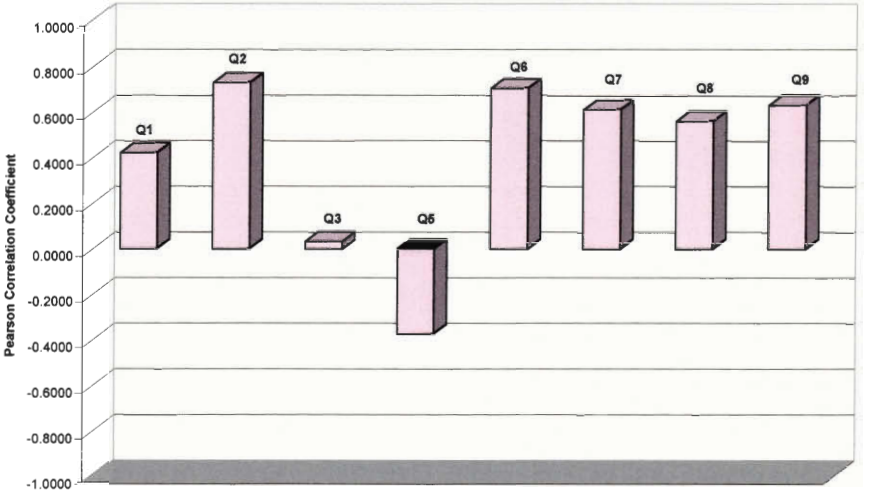
Correlations of Questions #1 and #3-9 With Question #2



Correlations of Questions #1-2 and #4-9 With Question #3

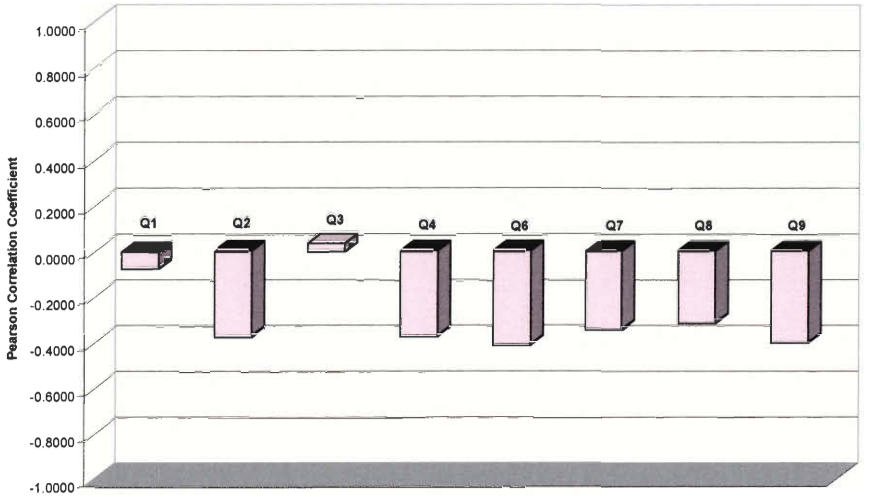


Correlations of Questions #1-3 and #5-9 With Question #4

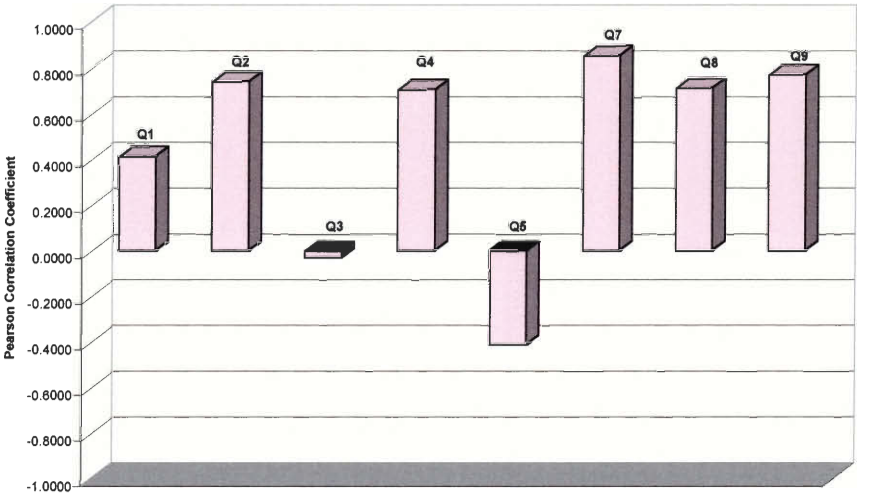


Plots of Correlation Coefficients for Questions #5-8 Compared With All Other Questions

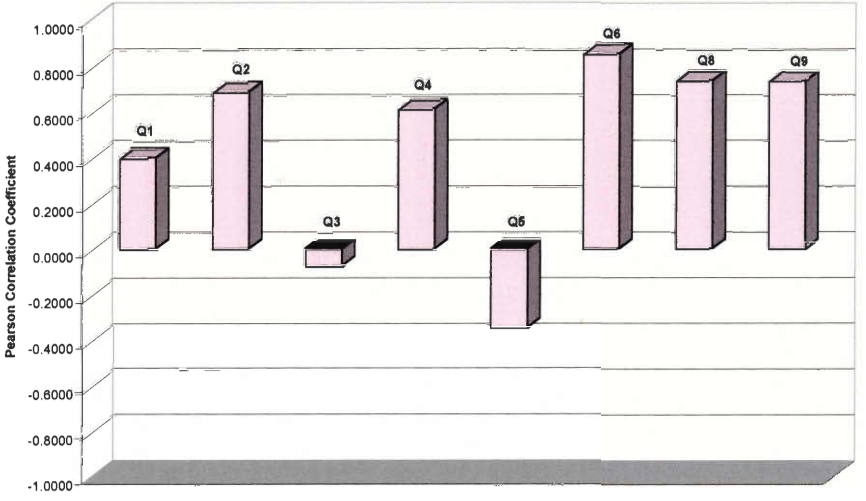
Correlations of Questions #1-4 and #6-9 With Question #5



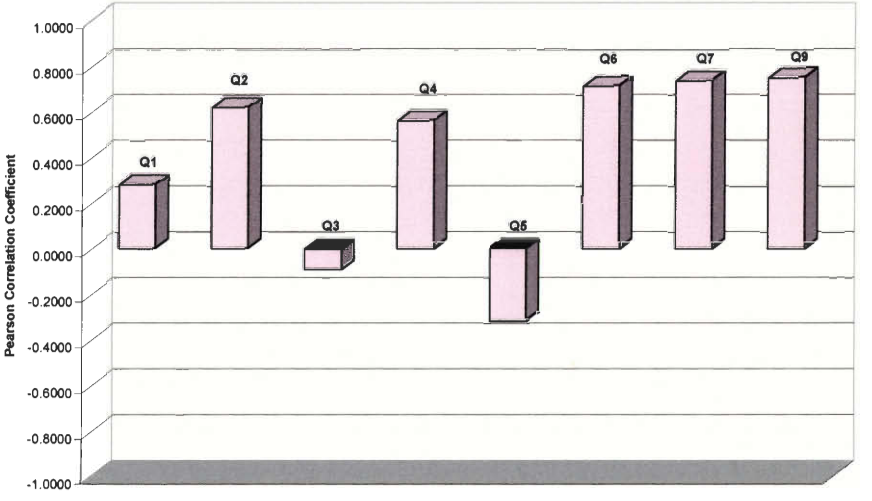
Correlations of Questions #1-5 and #7-9 With Question #6



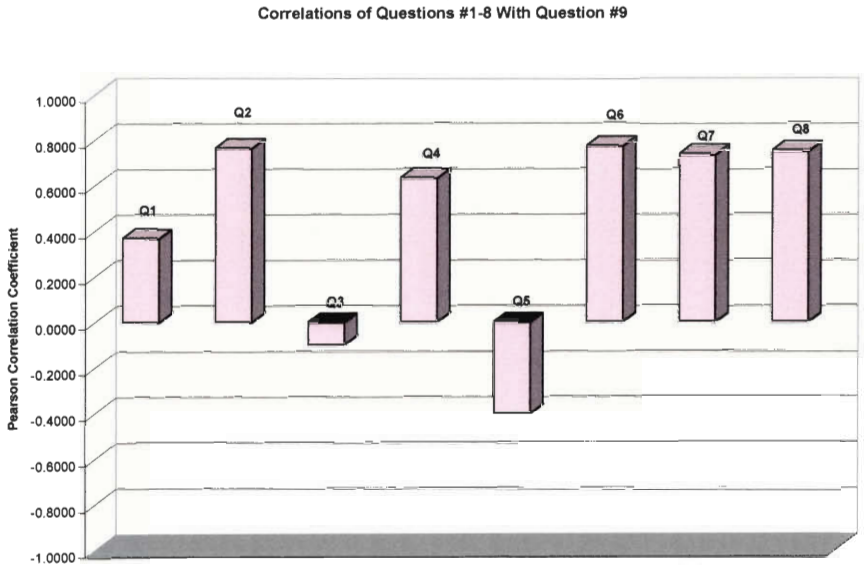
Correlations of Questions #1-6 and #8-9 With Question #7



Correlations of Questions #1-7 and #9 With Question #8



Plots of Correlation Coefficients for Question #9 Compared With All Other Questions



Appendix V- Description of Core Courses Already Offered at WPI

CH 1010. MOLECULARITY.
Cat. I
The theme of CH 1010 is the idea of molecularity: that all matter in the universe is composed of atoms bonded together in a limited number of ways. Molecularity is one of a small number of fundamental themes of chemistry (and of all science); it is important for us to address it immediately because it permeates all of chemistry. Specific concepts that we will discuss are presented below. Introduction to the Molecular View, Structures of Simple Molecules, Types of Compounds: The Periodic Table, Chemical Calculations, Types of Reactions, The Quantum Structure of the Atom

CH 1020. FORCES AND BONDING.
Cat. I
The theme of CH 1020 is forces and bonding. We will examine the origin and strength of electrical forces within molecules (covalent bonds), between positive and negative ions in a lattice (ionic bonds), and between atoms or molecules of a pure substance (intermolecular forces). Energy changes accompanying the rupture or formation of such bonds will be discussed. Specific concepts that we will discuss are presented below. Molecular Structure and Shape, Gases, Solids, Intra-and Intermolecular Forces, Liquids Energy (First Law of Thermodynamics)

CH 1030. EQUILIBRIUM.
Cat. I
The theme of CH 1030 is equilibrium. We will examine the nature of dynamic equilibrium at the molecular level, and will develop an understanding of the mathematical aspects of equilibrium. Phase equilibrium, further aspects of thermodynamics (entropy, free energy), equilibrium of chemical reactions in the gas phase, and equilibrium of chemical reactions in solution will be discussed. Specific concepts that we will discuss are presented below: Phase Equilibrium Chemical Equilibrium of Gas Phase Reactions, Solutions, Chemical Equilibrium of Reactions in Solution, Entropy and Free Energy

CH 1040. DYNAMICS.
Cat.I
The theme of CH 1040 is dynamics. We will examine the nature of molecular motions and their interaction with light, which provides us with all of our structural information about molecules. Various types of molecular spectroscopy will be discussed. Then we will turn to the dynamics of interactions between molecules, examining the rates of chemical reactions, and discussing the detailed molecular pathways by which they occur. Specific concepts that we will discuss are presented below. NMR Spectroscopy, Vibrational Spectroscopy, Electronic Spectroscopy, Dynamics of Physical Processes (Diffusion, phase changes, phase distribution), Dynamics of Chemical Processes

CH 2310. ORGANIC CHEMISTRY I.
Cat. I
A systematic survey of the major reaction types and functional groups in organic chemistry. The course will provide a representative collection of characteristic reactions and transformations of a variety of types of organic molecules. Most of the examples will be drawn from aliphatic chemistry. Some theoretical models will be introduced with a view toward establishing a general overview of the material. The course is intended for chemists, chemical engineers, pre-medical students and all those interested in the biosciences. A familiarity with the material presented in the general chemistry courses is assumed.

CH 2320. ORGANIC CHEMISTRY II.
Cat. I
Modern theories of aromaticity, including a general assessment of delocalized bonding. The chemistry of some significant functional groups not surveyed in Organic Chemistry I, and the meaning of acidity and basicity in organic chemistry, will be more fully explored. The course will provide an introduction to the systematic synthesis of polyfunctional organic compounds. Recommended background: CH 2310. The course is intended for chemists, chemical engineers and bioscience majors.

CH 2360. ORGANIC LABORATORY.
Cat. I
Laboratory experience in the preparation and characterization of organic substances. The course will also contain sufficient training in laboratory technique and data handling so that no previous laboratory experience beyond that of general chemistry will be assumed. (To be taken concurrently or following studies in organic chemistry.) Recommended for chemical engineers, pre-medical students, BB majors, and other nonchemists desiring chemical laboratory experience. One lecture and three three-hour labs.

CH 2640. EXPERIMENTAL CHEMISTRY I: INSTRUMENTAL ANALYSIS.
Cat. I
This laboratory course focuses on the application of modern instrumental methods of analysis to chemical, biochemical and environmental problems. Practical experience is gained in quantitative ultraviolet-visible spectrophotometry, bioluminescence, high performance liquid chromatography, and capillary electrophoresis. Generally, after a set exercise to illustrate the capabilities and use of a particular instrument, student teams select a chemical, biochemical or environmental problem of interest to them, formulate an approach, conduct the analysis, and present their findings to the class. Recommended background: CH 1010-CH 1040.

CH 4110. BIOCHEMISTRY I.
Cat. I
The principles of protein structure are presented. Mechanisms of enzymatic catalysis, including those requiring coenzymes, are outlined in detail. The structures and biochemical properties of carbohydrates are reviewed. Bioenergetics, the role of ATP,

and its production through glycolysis and the TCA cycle are fully considered. Recommended background: CH 2310, CH 2320. Suggested background: CH 2330.

CH 4120. BIOCHEMISTRY II.
Cat. I
Oriented around biological membranes, this term begins with a discussion of electron transport and the aerobic production of ATP followed by a study of photosynthesis. The study of the biosynthesis of lipids and steroids leads to a discussion of the structure and function of biological membranes. Finally the membrane processes in neurotransmission are discussed. Recommended background: CH 4110.

BB 1001. INTRODUCTION TO BIOLOGY.
Cat. I
This course consists of an overview of the major concepts of Biology, including: cell theory, bioenergetics, molecular biology, reproduction, nutrition, growth, development, homeostatic controls, and ecological issues. This course is intended for students seeking a broad overview of contemporary Biology with emphasis on human issues and current topics. Recommended background: high school or introductory college level chemistry.

BB 2920. GENETICS.
Cat. I
This course presents the principles and experimental evidence leading to our understanding of the gene concept and the role of DNA as genetic material. Patterns of inheritance, the relationship between genotype and phenotype, and transmission, coding, and expression of genetic information are considered in a variety of organisms. A quantitative, problem-solving approach and the use of genetic analysis as a tool to study biological phenomena are emphasized throughout the course. The course is designed for all biology and pre-professional majors. Recommended background: BB 1030 or equivalent.

BB 3518. MOLECULAR BIOLOGY.
Cat I (1/6 unit) Laboratory investigations of select molecular characteristics of proteins and DNA. Recommended background: BB 2940, BB 2550, CH 4110 and CH 4120. Concurrent, or prior registration in BB 4910 is recommended.

BB 3521. MICROSCOPY.
Cat I (1/6 unit) A laboratory course in the theory and operation of light and electron microscopes, including specimen preparation, operation of equipment, and microphotography. Recommended background: BB 2940 and BB 2550.

MA 1021. CALCULUS I.
Cat. I
This course provides an introduction to differentiation and its applications. Topics covered include: functions and their graphs, limits, continuity, differentiation, linear approximation, chain rule, min/max problems, and applications of derivatives.

Recommended background: Algebra, trigonometry and analytic geometry. Although the course will make use of computers, no programming experience is assumed.

MA 1022. CALCULUS II.
Cat. I
This course provides an introduction to integration and its applications. Topics covered include: inverse trigonometric functions, Riemann sums, fundamental theorem of calculus, basic techniques of integration, volumes of revolution, arc length, exponential and logarithmic functions, and applications. Recommended background: MA 1021. Although the course will make use of computers, no programming experience is assumed.

MA 2611. APPLIED STATISTICS I.
Cat. I
This course is designed to introduce the student to data analytic and applied statistical methods commonly used in industrial and scientific applications as well as in course and project work at WPI. Emphasis will be on the practical aspects of statistics with students analyzing real data sets on an interactive computer package. Topics covered include analytic and graphical representation of data, exploratory data analysis, basic issues in the design and conduct of experimental and observational studies, discrete and continuous probability models, the central limit theorem, and one and two sample point and interval estimation. Recommended background: MA 1022.

PH 1110. GENERAL PHYSICS - MECHANICS.
Cat. I
Introductory course in Newtonian mechanics.

Topics include: kinematics of motion, vectors, Newton's laws, friction, work-energy, impulse-momentum, for both translational and rotational motion.

Recommended background: concurrent study of MA 1021.

PH 1120. GENERAL PHYSICS - ELECTRICITY AND MAGNETISM.
Cat. I
An introduction to the theory of electricity and magnetism.

Topics include: Coulomb's law, electric and magnetic fields, capacitance, electrical current and resistance, and electromagnetic induction.

Recommended background: working knowledge of the material presented in PH 1110 or PH 1111 and concurrent study of MA 1022.

Appendix VI- Possible WPI Course Sequence

Year	A Term Classes	B Term Classes	C Term Classes	D Term Classes
Freshman	Calculus 1	Calculus 2	Intro. to Biology	Statistics
	Chemistry 1	Chemistry 2	Chemistry 3	Chemistry 4
	Physics 1	Physics 2	Sufficiency	Sufficiency
Sophomore	Organic Chem 1	Organic Chem 2	Organic Chem Lab	Inorganic Chem
	Genetics	Forensics	Forensics	Social Science
	Sufficiency	Sufficiency	Sufficiency	Sufficiency
Junior	Biochem 1	Biochem 2	Social Science	Criminal Science
	IQP	IQP	IQP	Elective
	Forensics	Forensics	Forensics	Forensics
Senior	Microscopy	Forensics	Forensics	Forensics
	MQP	MQP	MQP	Elective
	Forensics	Forensics	Forensics	Forensics

Appendix VII- Description of Proposed Forensic Science Courses

Introduction to Criminal Justice
Survey of criminal justice system with emphasis on prosecution, corrections and societal reaction to offenders. Retribution, rehabilitation, deterrence and incapacitation serve as generic frames of reference and theoretical points of departure for analyzing the dispositional and correctional processes. The course focuses on the process–from the police and prosecution through the courts; from the courts through the correctional system.

Criminal Law
The scope, purpose and definitions of substantive criminal law: criminal liability, major elements of statutory and common law offenses and significant defenses.

Principles of Criminal Investigation
Introduction to criminal investigation in the field. Conducting the crime scene search, interview of witnesses, interrogation of suspects, methods of surveillance and the special techniques employed in particular kinds of investigation.

Forensic Photography with Laboratory
Introduction to basic techniques, material and other aspects of crime scene photographs. Theory and practice of photographic image formation and recordings. Laboratory exercises with emphasis on homicide, sex offenses, arson and accident photograph techniques.

Introduction to Forensic Science
A classroom lecture/discussion session and a laboratory period. Topics include the recognition, identification, individualization and evaluation of physical evidence such as hairs, fibers, chemicals, narcotics, blood, semen, glass, soil, fingerprints, documents, firearms and tool marks.

Criminal Procedure I
An inquiry into the nature and scope of the U.S. Constitution as it relates to criminal procedures. Areas discussed include the law of search and seizure, arrests, confessions and identification.

Fingerprints with Laboratory
The genetics and mathematical theory relating to fingerprints, chemical and physical

methods used in developing latent fingerprints, and major systems of fingerprint classification.

Scientific Methods in Human Services
Introduction to the use of scientific methods and logic in the human service professions. Topics studied will include science and the scientific approach to problem solving, the logic of causal inference, problem and hypothesis formulation, the use of experimental designs, laboratory methods, survey research methods and measurement issues in human services.

Forensic Science Laboratory I and II
Specific examination of topics and laboratory testing procedures introduced in prior courses. In the classroom, laboratory procedures are outlined and discussed. Identification and individualization of evidence; casting of hairs and fibers for microscopic identification; electrophoretic separation of blood enzymes.

Criminology
An examination of principles and concepts of criminal behavior; criminological theory; the nature, extent and distribution of crime; legal and societal reaction to crime.

Advanced Forensic Science I with Laboratory
In-depth examination of blood grouping procedures for red cell antigens, isoenzymes and serum proteins, identification and typing of body fluids and their stains; collection, processing and handling of biological materials in casework.

Advanced Forensic Science II with Laboratory
In-depth examination of several subjects in modern criminalistics, including hair and fiber analysis and comparison, arson accelerants and explosives residues, glass comparisons and forensic chemistry.

Victimology
Introduction to the principles and concepts of victimology, analysis of victimization patterns and trends, and responses to criminal victimization.

Seminar in Forensic Science
An examination and evaluation of current issues in the law enforcement science field. Course aids in understanding how various physical evidence can be utilized as an investigative tool. Also, a review of modern analytical techniques and their application in law enforcement science.

Death Investigation—Scene to Court
An in-depth study of the principles and techniques associated with investigating homicides; suicides; and accidental, natural or equivocal deaths. While considering the sociological, psychological and legal aspects typically found in these cases, the process will take the student from the scene to the court--criminal or civil.

Internet Investigations and Audit-Based Computer Forensics
Theory and techniques for tracking attackers across the Internet and gaining forensic information from computer systems. The course includes case studies of Internet-based crimes and addresses limits of forensic techniques.

Practical Issues in Cryptography
Practical issues in cryptography, including examples of current historical cryptography and stegonagraphic systems; major types of cryptosystems and cryptanalytic techniques, and how they operate; hands-on experience with current cryptographic technology.

Computer Applications in Research and Program Evaluation
An advanced course reviewing major statistical packages and models employed in the analysis of criminal justice and human services data. Students will learn analytic techniques using real data sets. Program evaluation needs will be studied and tested.

Crime Mapping and Analysis
Survey of GIS research and applications in the field of public safety, including analysis of hot spots, density patterns and forecasts of crime patterns.

Domestic and Sexual Violence
An in-depth analysis of the typologies, causes, correlates, dynamics and effects of domestic and sexual violence and victimization. A review of treatment practices in these areas will be provided.

Law and Evidence
Comprehensive study of the rules of evidence particularly as applied to physical evidence. Includes: judicial notice, presumptions, hearsay rules, confessions admissions, scientific evidence and expert testimony. Emphasis on criminal law applications.

Research Methods and Statistics in Criminal Justice
An introduction to quantitative and qualitative methods used in criminal justice for research and policy analysis purposes. Students will become familiar with basic types of research designs, survey research methods, evaluation methods, descriptive statistics and inferential statistics.

Survey of Forensic Science
An introductory survey of forensic sciences and criminalistics, crime scene procedures

and documentation, and methods of laboratory analysis for students specializing in security and investigation.

Advanced Crime Scene Investigation
An in-depth study of crime scene procedures including recognition, protection, documentation; and collection of physical evidence; scene documentation, scene search procedures; and reconstructions from evidence and scene patterns.

Advanced Criminalistics I and Laboratory
The comparison and individualization of physical evidence by biological and chemical properties is presented in lectures and carried out in the laboratory. The theories and practice of microscopic, biological, immunological and chemical analysis are applied to the examination of blood, saliva, seminal fluid, hair, tissues, botanical evidence and other material of forensic interest.

Advanced Investigation I
An in-depth study of modern principles and techniques of criminal and civil investigations. Management of investigations, use of witnesses, interviewing, polygraph, backgrounds, establishment of MO, missing persons, surveillance and investigation of questioned deaths and death scenes.

Advanced Investigation II
An in-depth study of the principles and techniques of criminal and civil investigations. Investigation of fraud, embezzlement, white-collar crime, property crimes, sexual assaults and other crimes against persons; extortion; kidnapping; drug trades; and traffic accidents.

Advanced Criminalistics II and Laboratory
Introduction of advanced microscopic, chemical and instrumental methods with extensive hands-on experience provided by a laboratory section. Principles and methods of analysis of microscopic and macroscopic evidence such as glass, soil, papers, inks, dyes, paints, varnishes, explosives, fibers, drugs and other potential physical traces will be discussed in class.

Drug Chemistry and Identification
Introduction to licit and illicit drugs as evidence, followed by an overview of chemical, microscopic and instrumental techniques used for their identification; discussion of sampling, separation and quantitation of evidence specimens; presentation of drug chemistry expert testimony in courts of law.

Fire Scene Investigation and Arson Analysis
The techniques of crime scene documentation and investigation as they relate to fire and explosion scenes. Evidence recognition and collection. Laboratory analysis of fire scene, arson accelerant and explosion scene residues. Scientific proof of arson.

Death Investigation-Scene to Court
An in-depth study of the principles and techniques associated with investigating homicides, suicides and accidental, natural or equivocal deaths. While considering the sociological, psychological and legal aspects typically found in these cases, the process will take students from the scene to the court, criminal or civil.

Physical Analysis in Forensic Science and Laboratory
The classic firearms examination, classification and comparison of bullets and cartridges, toolmarks comparison and striation analysis, serial number restoration, document examination, voiceprint identification, fingerprints and polygraphy examination.

Forensic Microscopy
Basic techniques of optical microscopy and the development of operational skills for the use of the microscope as a tool of evidence detection and evaluation. Microscopical measurements and analytic methods will be covered.

Medicolegal Investigation and Identification
An introduction to procedures and techniques for medicolegal investigation of questioned death and identification of deceased persons, including autopsy technique, odontological procedures and anthropological approaches.

Forensic Toxicology
An in-depth analysis of forensic toxicological procedures and methods; determinations of metallic, volatile and soluble poisons; analysis for narcotic drugs and other drugs of abuse and dosage form drugs that are commonly abused or found contributing to cause of death.

Advanced Forensic Serology I
A comprehensive study of the theory and practice of isoenzyme, serum protein and immunoglobulin genetic markers in human blood and body fluids. Electrophoretic and isoelectric focusing techniques. Interpretation of genetic marker results in blood individualization.

Advanced Forensic Serology II
A comprehensive study of the theory and practice of biochemical and immunologic procedures for blood and body fluid identification; typing of Rh, MNSs and other red cell antigens in blood and blood stains; antiserum selection and evaluation; ELISA techniques; DNA polymorphism analysis.

Contemporary Issues in Investigation
A series of lectures highlighting contemporary methods enhancing the investigative process. Techniques such as multidisciplinary approach, cold case review, task force response, crime analysis, criminal signature studies, crime mapping, electronic investigating and criminal data basing will be emphasized. Lectures will be augmented by special guest presentations and by examination of prominent cases.

Biomedical Methods in Forensic Science and Laboratory
Methods and application of modern toxicology, biochemistry, pathology, dentistry and medicine in forensic science.

Fire/Accident Scene Reconstruction
Application of principles of reconstruction of the scene of a fire or accident, including proper procedure for examining physical evidence to determine cause. Emphasis on preparation of reports, testimony for hearings and trials, rendering of advisory opinions to assist in resolution of disputes affecting life and property.

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