PROPOSAL FOR
NEW DEGREE PROGRAMME IN
FORENSIC SCIENCE

1. PROGRAMME IDENTIFICATION

1.1 Submitting Institution : University of New Brunswick in Saint John
1.2 Faculty : Science, Applied Science and Engineering
1.4 Department : Physical Sciences
1.5 Programme Name and Level : Forensic Science (Undergraduate, Major)
                             Forensic Science (Undergraduate, Honours)
1.6 Degree Awarded : Bachelor of Forensic Science
1.7 Proposed Starting Date : September 2003

2. PROGRAMME DESCRIPTION

2.1 Programme Objectives

The Bachelor of Forensic Science programme is designed to provide:

i) an interdisciplinary programme designed to meet a need for high-quality,
   problem-solving graduates skilled in chemical and material analysis

ii) graduates who may wish to pursue a career in forensic or analytical sciences

iii) a broadly based education in analytical measurement comprising the chemistry,
     biology and psychology as applicable to investigative analytical and forensic
     science, together with a fundamental knowledge of legislation, policy formulation
     and the principles of investigation relevant to criminological study

Forensic Science is the application of science to the investigation of crime. The
crime is not limited to crime against individuals such as homicide, theft, fraud, and arson.
Forensic Scientists are also involved in the investigation of crime against society, such as food
adulteration, environmental pollution, use and distribution of unsafe chemicals and dangerous
working conditions.

Forensic Science is the study of physical evidence in a modern legal context. There are
many sub-fields of Forensic Science including Forensic Anthropology, Forensic Biology,
Forensic Chemistry, Forensic Entomology, Forensic Toxicology, Forensic Accounting etc. The single, unifying systematic arrangement of Forensic Science is the search for the true meaning of evidence in both criminal investigations and courts of law.

The proposed programme is intended to be complimentary to and not in conflict with other developing programmes within the Department of Physical Sciences [or elsewhere].

It would contain core elements of the present science offerings with a bias towards Chemistry and Biology, plus electives from those courses required for the present Psychology programme and the Criminal Justice Minor.

New courses in Forensic Science will be introduced.

Other courses not at present offered at University of New Brunswick - Saint John but available at University of New Brunswick - Fredericton would be taken as part of the elective course load of the programme (taking note of the tele/video-conferencing facilities at the University of New Brunswick - Saint John).

The benefits for the University of New Brunswick - Saint John of an undergraduate programme in Forensic Science include:

. support and enhancement of other programmes such as Biology, Psychology, Social and Health Sciences;
. opportunities for collaborative interdepartmental projects;
. direct collaboration of analytical section with various environmental biology programmes and projects;
. modern equipment available for a variety of projects;
. increased number of course offering for chemistry and biology majors;
. graduate student participation in teaching, tutorials and laboratory demonstrators with diminished requirement for stipends;
. research oriented Faculty: - possibility for major equipment group applications (NMR, HPLC, ultracentrifuge, etc.)
2.2 Overall Programme Structure

1. Existing courses in Chemistry, Biology, Psychology and other disciplines, have been incorporated into the programme in order to build on existing strengths of the Saint John campus.

2. Proposed new courses, mainly in the 3rd and 4th year, fill particular needs within the programme.

   Years 1 and 2 of the proposed Forensic Science programme overlap with the current Chemistry, Biology and Biology/Chemistry and proposed Medicinal Chemistry programmes. Therefore, consequently, within the first two years students will be able to switch between programmes with a minimum of make-up courses to satisfy different degrees requirements.

3. Required and elective courses outside Chemistry are included. The main goal of the programme is to train forensic scientists with excellent technical and problem solving skills and a broad background that would allow them to integrate readily information from other related disciplines.

2.3 Anticipated Student Outcomes and their relevance

Anticipated Student Interest

Across Canada there are only a small number of Forensic Science programmes. A double major in Forensic Science is offered at the University of Toronto - Erindale Campus. There the student majors in Chemistry, or Biology or Anthropology and takes Forensic Science as a second major. St. Mary's University in Halifax has introduced a Diploma in Forensic Science. Trent University and the University of Windsor have recently mounted such programmes.

In the USA, there are about a dozen undergraduate programmes that offer training in forensic sciences. Worldwide there are a further handful of undergraduate programmes - University of Technology, Sydney, Australia, and the University of Strathclyde, Scotland being two such programmes.

It is believed, however, that an undergraduate degree programme with specialization in Forensic Science is at this time very desirable. Apart from preparing students for careers in Forensic science immediately upon graduation, such a programme will also provide an excellent background for entrance into health professional schools and prepare students for graduate work in a variety of fields.
Forensic Science as Pre-Medicine

Because of the extensive background in biology, chemistry, and other sciences, forensic science majors will find they will have a good foundation for careers in medicine, dentistry, pharmacy, veterinary medicine, nursing, medical technology and other bio-medical fields.

Forensic Science as Pre-Law

Most criminal lawyers, prosecutors and judges are unprepared in understanding the capabilities of modern forensic sciences. The combination of forensic science and law will make for exceptional lawyers in criminal as well as civil cases. Also this combination would appeal to private corporations, which have to deal with governmental regulations, patent infringements, industrial piracy and product liability.

Forensic Science for Graduate Work

A Forensic Science degree would prepare students to pursue graduate work in forensic science, environmental sciences, industrial hygiene, analytical or medicinal chemistry, or toxicology.

Forensic Science for Police Work

Increasingly, forensic scientists are being employed to investigate suspicious deaths, mass disasters and political atrocities. Most students with a Bachelor of Forensic Science may seek employment with various police agencies. Police agencies are looking for candidates who fulfill the basic requirements for police officers plus have special knowledge in forensic science.

It is expected that the proposed undergraduate degree will attract new students to the University of New Brunswick, those who wish to enter the forensic science job-market, but do not feel that their interests are being met by a “traditional” BSc degree in biology or chemistry or biology-chemistry, as well as students who are preparing for research in various professions which are forensic based.

Representatives of potential employers (e.g. police forces and coroner’s office) have been consulted to determine their interest in graduates of the proposed programme. They have also been asked to provide comments on the proposed curriculum, and many of their suggestions have been incorporated.

Depending upon the choice of electives, this program will provide an optimum background for employment as a BSc-level forensic scientist in research institutes, industry, hospital laboratories, and government; for entrance to
graduate school in this or related areas; and for entrance to graduate schools of forensic studies.

2.4 Admission Requirements

Admission requirements are the same as for an University of New Brunswick Bachelor of Science degree.

2.5 Programme Outline

Normal years of study will be four(4), with students taking 5 courses per term(labs are additional in some cases).

The curriculum consists of a set of core requirements plus free electives. Particular emphasis is placed on topics of analytical chemistry, which are applicable in the forensic laboratory, such as identification of drugs and other physical samples, biochemical assays, such as DNA, and the use of separation methods.

Description of programme:

The programme is offered at both Majors and Honours level.

Majors Programme

The total minimum credit hours for the completion of the Majors level is 150.

A grade of “C” or better is necessary in any required course in the programme.

Honours Programme

The total minimum credit hours for completion of the Honours level is 156.

Entry into the Honours programme is allowed after second year provided that a minimum CGPA of 3.2 has been attained for all subjects taken in the degree programme. A CGPA of 3.2 must be maintained in subsequent years. The graduating honours student must achieve a minimum CGPA of 3.7 for First Class Honours standing and a minimum CGPA of 3.2 for Second Class Honours standing. A student completing all the course requirements for Honours but with a CGPA below 3.2 will be given a Major degree. Students must notify the Department at the end of the second year of their intent to follow an Honours Programme for appropriate academic advising.

The requirement for Honours standing includes successful completion of FRNC 4700 Honours Research Project in Forensic Science
A grade of "C" or better is necessary in any required course in the programme.

**Descriptions of core forensic science courses:**

The number and content of the core requirements in forensic science would vary with the new faculty expertise and interests.

**Forensic Science I - Principles of Forensic Science  FRNC 2701**
This provides a broad overview of forensic science. It is designed to introduce the different disciplines, principles and concepts peculiar to forensic science. It covers, in the forensic context, the following areas: history, general definitions and concepts, sub-disciplines, methodology and methods, introduction to crime scene, trace typology, function of expert, legal system, judicial admissibility, ethical considerations, interpretation of forensic evidence.

**Forensic Science II - Forensic Imaging   FRNC 2702**
Covers application of light theory in forensic science (absorption, reflection, UV, IR, diffusion, epidiscopic coaxial illumination, polarised light, photoluminescence etc), technical and forensic photography (use of large and medium format and single lens reflex cameras), image treatment, optical and electron microscopy, comparison microscopy.

**Forensic Science III - Forensic Toxicology I  FRNC 3701**
An introduction to the fundamentals of forensic toxicology. It involves specific forensic material, general pharmacology and toxicology. The subject also gives an overview of Provincial & Federal laws concerning licit and illicit drugs & poisons.

**Forensic Science IV - Forensic Toxicology II  FRNC 3702**
An advanced course dealing in some depth with analytical details of the areas covered. The course enables the pharmacology and toxicology of drugs such as cannabis, amphetamines, opiates and cocaine to be taught on parallel with other aspects of these drugs.

**Forensic Science V/VI/VII - Selected topics in Forensic Science  FRNC 4701/4702/4705**
Forensic cases from chemical & legal standpoints - specialists in forensic science could lecture on a variety of topics including crime scene investigation, the role of the coroner, forensic pathology, forensic botany, forensic entomology, forensic dentistry, psychology and toxicology.

Further courses in aspects of the “Physical Evidence” of the crime scene would act as follow-on courses from FRNC 4701/4702/4705

Courses of this type would be on such topics as fingerprint detection & identification, footwear & tire impression, weapons including firearms, bullet/cartridge identification, gunshot residues etc. Further areas covered could be forensic analysis of soil, paint, hair and documents.
A forensic research project, work term, or internship (FRNC 4700 Honours Research Project in Forensic Science) in a crime or forensic laboratory would be required for those students taking the Honours level.

Implicit to the proposed “science” content of the programme above is the use of those courses presently taught in the Criminal Justice Minor at University of New Brunswick - Saint John as electives for this degree. The forensic science programme has mandatory courses PSYC 3263 Psychology of Criminal Behaviour & SOCI 2611 Criminology I and SOCI 2614 Criminology II.

In addition to these required courses students could choose elective courses from:

- HIST 3386 Canadian criminal justice system 3ch
- PHIL 2124 Contemporary moral problems 3ch
- POLS 1201 Canadian government & politics 6ch
- PSYC 3313 Introduction to psychological testing 3ch
- PSYC 3493 Changing behaviour 3ch
- PSYC 3553 Abnormal psychology 3ch
- PSYC 3752 Drugs & behaviour 3ch
- SOCI 2603 Sociology of deviance 3ch
- SOCI 3611 Socio-legal Studies 3ch
- SOCI 3901 Sociology of policing 3ch
- SOCI 4603 Special topics in criminological theory 3ch
- SOCI 4613 Special topics in socio-legal studies 3ch

Further elective courses could be taken from the existing University of New Brunswick - Fredericton anthropology courses if these were available to students at University of New Brunswick - Saint John via either on-site teaching or video-conferencing, namely:

- ANTH 1002 Introduction to paleo-anthropology 3ch
- ANTH 2502 Introduction to biological anthropology 3ch
ANTH 3340 Archaeological lab. school 6ch
ANTH 3350 Archaeological field school 6ch
ANTH 3502 Medical anthropology 3ch
ANTH 3522 Human variation 3ch

A possible “new” advanced physical anthropology course specifically devoted to Forensic Anthropology - skeletal investigations, would be desirable as well.

The following codes are used to indicate courses in the remainder of this proposal.

**Font** | **Meaning**
--- | ---
REGULAR (with full 4 digit number & description) e.g. BIOL 1001 | Existing course at UNB - SJ
*ITALICS* (with full 4 digit number & description) e.g. *CHEM 3132* | Existing UNB - F course which could be used as a model for development and adoption as a new course in the programme or a new UNB course to be developed to fit requirements of programme
I YEAR 1
As is the requirement for all properly qualified students entering the first year of a BSc programme, those interested in a Bachelor of Forensic Science will normally complete the following courses.

1. Required Courses

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Course Name</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOL 1001</td>
<td>Biological Principles I</td>
<td>3ch</td>
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<tr>
<td>BIOL 1012, 1017</td>
<td>Biological Principles II</td>
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<tr>
<td>CHEM 1041</td>
<td>General Chemistry I</td>
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<td>CHEM 1046</td>
<td>Introductory Chemistry Lab I</td>
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<td>CHEM 1072</td>
<td>General Chemistry II</td>
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</tr>
<tr>
<td>CHEM 1077</td>
<td>Introductory Chemistry Lab II</td>
<td>2ch</td>
</tr>
<tr>
<td>MATH 1003</td>
<td>Introduction to Calculus I</td>
<td>3ch</td>
</tr>
<tr>
<td>MATH 1013</td>
<td>Introduction to Calculus II</td>
<td>3ch</td>
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<tr>
<td>PHYS 1000</td>
<td>Elements of Physics</td>
<td>9ch</td>
</tr>
<tr>
<td>SOCI 1001</td>
<td>Introductory Sociology</td>
<td>3ch</td>
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<tr>
<td>TOTAL</td>
<td></td>
<td>36ch</td>
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2. Suggested elective courses

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Course Name</th>
<th>Credits</th>
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<tbody>
<tr>
<td>*ANTH 1002</td>
<td>Introduction to Paleo-anthropology</td>
<td>3ch</td>
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<tr>
<td>BIOL 1411</td>
<td>Anatomy &amp; Physiology I</td>
<td>3ch</td>
</tr>
<tr>
<td>BIOL 1416</td>
<td>Anatomy &amp; Physiology Lab. I</td>
<td>2ch</td>
</tr>
<tr>
<td>*HIST 1301</td>
<td>Canadian Historical Issues</td>
<td>3ch</td>
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</table>
*POLS 1201  Canadian government & politics  3ch

TOTAL  14ch

* These courses would be required if the corresponding upper level courses are taken in these disciplines

Comment: Suggested number of credits in the first year is 42 credit hours

I YEAR 2
1. Required courses

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<tr>
<td>BIOL 2065</td>
<td>Introductory Biochemistry</td>
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<tr>
<td>CHEM 2111</td>
<td>Introductory Analytical Chemistry</td>
<td>5ch</td>
</tr>
<tr>
<td>CHEM 2401</td>
<td>Organic Chemistry I</td>
<td>3ch</td>
</tr>
<tr>
<td>CHEM 2416</td>
<td>Organic Chemistry Laboratory I</td>
<td>2ch</td>
</tr>
<tr>
<td>CHEM 2422</td>
<td>Organic Chemistry II</td>
<td>3ch</td>
</tr>
<tr>
<td>CHEM 2457</td>
<td>Organic Chemistry Laboratory II</td>
<td>2ch</td>
</tr>
<tr>
<td>CHEM 2201</td>
<td>Introduction to Inorganic Chemistry I</td>
<td>3ch</td>
</tr>
<tr>
<td>CHEM 2222</td>
<td>Introduction to Inorganic Chemistry II</td>
<td>3ch</td>
</tr>
<tr>
<td>CHEM 2237</td>
<td>Introduction to Inorganic Chemistry Laboratory</td>
<td>2ch</td>
</tr>
<tr>
<td>SOCI 2611</td>
<td>Qualitative Criminology I</td>
<td>3ch</td>
</tr>
<tr>
<td>SOCI 2614</td>
<td>Qualitative Criminology II</td>
<td>3ch</td>
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<tr>
<td>STAT2264</td>
<td>Statistics for Biologist I</td>
<td>3ch</td>
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TOTAL  36ch

2. Suggested elective courses

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Course Name</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANTH 2502</td>
<td>Introduction to Biological Anthropology</td>
<td>3ch</td>
</tr>
<tr>
<td>Course No.</td>
<td>Course Name</td>
<td>Credits</td>
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<tr>
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</tr>
<tr>
<td>BIOL 2245</td>
<td>Introductory Molecular Cell Biology</td>
<td>4ch</td>
</tr>
<tr>
<td>BIOL 2485</td>
<td>Introduction to Microbiology</td>
<td>4ch</td>
</tr>
<tr>
<td>*CHEM 2601</td>
<td>Chemical Thermodynamics</td>
<td>3ch</td>
</tr>
<tr>
<td>*CHEM 2622</td>
<td>Electrochemistry &amp; Chemical Kinetics</td>
<td>3ch</td>
</tr>
<tr>
<td>*CHEM 2637</td>
<td>Physical Chemistry Laboratory</td>
<td>2ch</td>
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<tr>
<td>MATH 2503</td>
<td>Calculus &amp; Linear Algebra for Engineers I</td>
<td>3ch</td>
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<tr>
<td>MATH 2513</td>
<td>Calculus &amp; Linear Algebra for Engineers II</td>
<td>3ch</td>
</tr>
<tr>
<td>PHIL 2124</td>
<td>Contemporary Moral Problems</td>
<td>3ch</td>
</tr>
<tr>
<td>*PHYS 2975</td>
<td>Light &amp; Sound</td>
<td>5ch</td>
</tr>
<tr>
<td>SOCI 2603</td>
<td>Sociology of Deviance</td>
<td>3ch</td>
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<tr>
<td><strong>TOTAL</strong></td>
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<td>36ch</td>
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</tbody>
</table>

* These courses have MATH 2503/2513 as co-requisite courses.

**Comment:** Suggested number of credits in the second year is **39 credit hours**

**III/IV YEAR 3 AND 4**

Courses proposed for 3rd and 4th year

1. **Required courses**

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Course Name</th>
<th>Credits</th>
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<tbody>
<tr>
<td>BIOL 3132</td>
<td>Advanced Biochemistry</td>
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<tr>
<td>CHEM 3132</td>
<td><em>Intermediate Analytical Chemistry</em></td>
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<tr>
<td>CHEM 3401</td>
<td>Organic Chemistry III</td>
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<tr>
<td>CHEM 3416</td>
<td>Organic Chemistry Laboratory III</td>
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<tr>
<td>CHEM 3422</td>
<td>Organic Chemistry IV</td>
<td>3ch</td>
</tr>
<tr>
<td>CHEM 3437</td>
<td>Organic Chemistry Laboratory IV</td>
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### Course Catalogue

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Course Name</th>
<th>Credits</th>
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<tbody>
<tr>
<td>CHEM 4111</td>
<td>Instrumental Analytical Chemistry I</td>
<td>3ch</td>
</tr>
<tr>
<td>CHEM 4132</td>
<td>Instrumental Analytical Chemistry II</td>
<td>3ch</td>
</tr>
<tr>
<td>FRNC 3702</td>
<td>Forensic Science IV Forensic Toxicology II</td>
<td>3 ch</td>
</tr>
<tr>
<td>FRNC 2701</td>
<td>Forensic Science I - Principles of Forensic Science</td>
<td>3ch</td>
</tr>
<tr>
<td>FRNC 2702</td>
<td>Forensic Science II - Forensic Imaging</td>
<td>3ch</td>
</tr>
<tr>
<td>FRNC 3701</td>
<td>Forensic Science III - Forensic Toxicology I</td>
<td>3ch</td>
</tr>
<tr>
<td>FRNC 4700</td>
<td>Honours Research Project in Forensic Science</td>
<td>6ch</td>
</tr>
<tr>
<td>FRNC 4701/4702/4705</td>
<td>Forensic Science V/VI/VII - Selected Topics in Forensic Science</td>
<td>9ch</td>
</tr>
<tr>
<td>PSYC 1003/4</td>
<td>Introductory Psychology</td>
<td>6 ch</td>
</tr>
<tr>
<td>PSYC 3263</td>
<td>Psychology of Criminal Behaviour</td>
<td>3ch</td>
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<tr>
<td>SOCI 3610</td>
<td>Criminology</td>
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<td><strong>TOTAL</strong></td>
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* 66 ch if Honours Project taken

### Elective Courses

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<th>Course Name</th>
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<tbody>
<tr>
<td>ANTH 3340</td>
<td>Archaeological Laboratory School</td>
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<td>ANTH 3350</td>
<td>Archaeological Field School</td>
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<tr>
<td>ANTH 3502</td>
<td>Medical Anthropology</td>
<td>3ch</td>
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<tr>
<td>ANTH 3522</td>
<td>Human Variation</td>
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<td>CHEM 3202</td>
<td>Advanced Inorganic Chemistry I</td>
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<td>CHEM 3221</td>
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<td>CHEM 3236</td>
<td>Advanced Inorganic Chemistry Laboratory</td>
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<td>CHEM 3503</td>
<td>Bio-organic Chemistry of Nucleic Acids</td>
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<td>CHEM 3523</td>
<td>Bio-organic Chemistry of Proteins</td>
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<td>CHEM 3641</td>
<td>Physical Organic Chemistry I</td>
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<td>CHEM 3642</td>
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<td>CHEM 3647</td>
<td>Physical Organic Chemistry Laboratory</td>
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<td>CHEM 4422</td>
<td>Advanced Organic Chemistry</td>
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<td>HIST 3386</td>
<td>Canadian Criminal Justice System</td>
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<td>PSYC 3313</td>
<td>Introduction to Psychological Testing</td>
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<td>PSYC 3493</td>
<td>Changing Behaviour</td>
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<td>PSYC 3553</td>
<td>Abnormal Psychology</td>
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<td>PSYC 3752</td>
<td>Drugs &amp; Behaviour</td>
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<tr>
<td>SOCI 3611</td>
<td>Socio-legal Studies</td>
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<tr>
<td>SOCI 3700</td>
<td>Studies in Urban Sociology</td>
<td>6ch</td>
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<tr>
<td>SOCI 3901</td>
<td>Sociology of Policing</td>
<td>3ch</td>
</tr>
<tr>
<td>SOCI 4603</td>
<td>Special Topics in Criminological Theory</td>
<td>3ch</td>
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<tr>
<td>SOCI 4613</td>
<td>Special Topics in Socio-legal Studies</td>
<td>3ch</td>
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<tr>
<td>STAT 3264</td>
<td>Statistics for Biology II</td>
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<td><strong>TOTAL</strong></td>
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</table>

Comment: Suggested number of credits in the third and four year for majors is 69ch total excluding FRNC 4700 and for honours is 75 total including FRNC 4700

2.7 Method of programme delivery:

Primarily classroom and laboratory with some project work.

3. RESOURCE IMPLICATIONS

3.1 Human and Physical Resources

3.1.1 Use of current resources:
As many pre-existing courses as possible, in Chemistry and other departments, were incorporated to build on existing strengths of the Saint John Campus. Proposed new courses fill particular need within the programme. Years 1 and 2 of the proposed Forensic Science programme are similar to the present Chemistry, Biology and Biology/Chemistry programmes.

3.1.2 Additional Resources needed:

Minimal requirements to initiate the programme:

i) a forensic chemist in year 2
ii) a toxicologist in year 3
iii) a physical chemist in year 3 - 4
iv) technical support staff in year 3

Faculty:

In essence the courses required for the first two years of the proposed Forensic Science programme are in place and currently staffed.

During the 1st year of implementation of the programme, a forensic chemist would be recruited to deliver courses in forensic science. The appointment will be made during the 2nd year to facilitate the development of courses for third year as well as direct the procurement of equipment. This time frame also allows for development of research interests prior to taking on a teaching load.

Faculty with expertise in toxicology would be recruited in year 2 to teach courses in this subject area, further broaden the research base and obtain required equipment. Sequence of events similar to the forensic chemist but with a one year delay.

Replacement departmental faculty would have to be hired in Physical Chemistry to service not only the present courses in Physical Chemistry which will be required for the continuation of core offerings within the Chemistry Discipline, but also to service the proposed Forensic Science and Medicinal Chemistry programmes

It should be noted that the implementation timetable includes a significant rearrangement of the work loads of existing faculty, which cannot be fully predicted and is dependant on the backgrounds of the additional faculty. In the short term, new courses will need to be developed by current faculty which will stretch this resource.
It is unquestionable that further faculty will have to be hired in subsequent years to give necessary quality and sufficient breadth of experience both in teaching and research to the programme.

Certain areas of expertise would be covered or expanded by the use of outside experts from police crime & government analytical laboratories.

[Expert advice could be utilized from local area textile manufacturers, photographic studios.]

In summary:
Although the lower level courses in the Sciences and most of the Arts courses, including the Criminal Justice requirement, would be taught by present UNB faculty. Upper level courses [existing & new] require the hiring of new faculty.

New faculty would have to be hired in Forensic Chemistry/Science, Medicinal & Toxicological Chemistry and Bio-organic Chemistry. This will breadth to the programme and serve as a linkage between this Forensic Science programme and the proposed Medicinal Chemistry programme.

**Support Staff:**

A technician(or laboratory instructor), would be hired in the 3rd year of programme implementation to maintain equipment, carry out experiments and assist in the laboratory courses.

Because of the heavy laboratory component of the programme, additional technical assistance will be required to prepare for and run these laboratories.

**Equipment:**

The programme will expose students to modern methods of analysis in such basic techniques as UV/Visible spectroscopy, Infra-red spectroscopy, Gas chromatography - Mass Spectrometry, Atomic Absorption spectroscopy, etc.

New and additional equipment will be required to support the development of the Forensic Science programme (and the present operating conditions of the Department) in the initial start-up and subsequent years.
Library Resources

There are existing library resources for most of the lower level chemistry and biology courses, however, resources should be obtained and/or increased in such areas as analytical chemistry, forensic and pharmaceutical chemistries, toxicology, etc.

3.1.3 Other Departments:

The Forensic Science programme will support and enhance several other programmes such as Biology, Psychology, Social and Health Sciences. It may well increase enrolment in the courses common to several disciplines and create new elective courses for students in biology, psychology and social sciences. It will provide opportunities for collaborative interdepartmental research projects; for example environmental biology projects will be enhances by collaboration with the analytical section. The availability of modern equipment will benefit a variety of interdepartmental projects. The increase in research oriented Faculty will open the possibility for acquiring major equipment through group applications.

3.1.4 Estimate of resources beyond year 5

Additional resources are anticipated beyond year 5 for the probable hiring of faculty to broaden the areas of subject expertise both in teaching and research within the programme.

3.2 Financial Implications

3.2.1 Costs

<table>
<thead>
<tr>
<th></th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Faculty</td>
<td>0</td>
<td>70000</td>
<td>190000</td>
<td>260000</td>
<td>260000</td>
</tr>
<tr>
<td>Stipends</td>
<td>3800</td>
<td>7600</td>
<td>11400</td>
<td>11400</td>
<td>11400</td>
</tr>
<tr>
<td>Library acquisitions</td>
<td>34000</td>
<td>34000</td>
<td>34000</td>
<td>32000</td>
<td>32000</td>
</tr>
<tr>
<td>Equipment</td>
<td>25000</td>
<td>115000</td>
<td>75000</td>
<td>75000</td>
<td>75000</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>62800</strong></td>
<td><strong>226600</strong></td>
<td><strong>310400</strong></td>
<td><strong>378400</strong></td>
<td><strong>378400</strong></td>
</tr>
</tbody>
</table>
“Faculty” implies the hiring of

i) a forensic chemist/scientist in year 2

ii) a toxicologist in year 3

iii) a physical chemist in year 3/4

iv) technical support staff in year 3

3.2.2 Anticipated Revenue

We assume a minimum of 15 new students at entry due to the new programme with an attrition rate of 30% from year to year. Based on this conservative estimate, costs will be covered by increased tuition revenues:

<table>
<thead>
<tr>
<th>New students in program</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>15</td>
<td>25</td>
<td>32</td>
<td>37</td>
<td>37</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Additional tuition revenue</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>59175</td>
<td>98625</td>
<td>126240</td>
<td>145965</td>
<td>145965</td>
</tr>
</tbody>
</table>

3.2.3 Operating or capital funding

It is not anticipated that there would be any substantial new operating or capital funding requirements in the first two years of the programme, other than that of the necessary “advertising” of this new programme.

*However, due to the laboratory emphasis to both this Forensic Science programme and the proposed Medicinal Chemistry programme, there will be ultimately increased capital funding required. This will provide increased laboratory space both for teaching and research in the areas of expertise required for both programmes. Further new office space will be a requirement for new faculty and their graduate students.*

Resource requirements

i) Initial cost of designing and producing promotional materials for the Forensic Science & Medicinal Chemistry programmes would conservatively be in the range of $10,000 to $15,000
ii) Classroom space

The Forensic Science programme requires upwards of 16 new lecture courses: 10 required and 6 elective. The Medicinal Chemistry programme will also add to the number of new courses being taught. There will therefore, be a need to maximize the creativity of timetabling in terms of the length and frequency of classes to accommodate these new lecture courses, if no new classroom space is available. Class size is expected to be small, but this should not preclude new and multimedia adaptive lecture space being available.

iii) Teaching laboratory space

The present GH 305 “sophomore” laboratory space, the only laboratory suitable for the programme presents a problem. There are 7 new laboratory courses proposed for this programme and even more laboratory courses would be required to support the Medicinal Chemistry programme. Given that this space already is used for the present core courses in Analytical Chemistry, Physical Chemistry, Inorganic Chemistry & Organic Chemistry, if no new teaching laboratory space is made available, then evening & weekend use of this space would be a requirement. Realistically new teaching laboratory space would be needed of a size equal to, if not larger than, the present “sophomore laboratory GH 305.

iv) Equipment laboratory space

Both the Forensic Science & Medicinal Chemistry programmes rely heavily on the acquisition of new instrumentation. The present “instrument” room is inadequate in both space and environment to house additional equipment such as GC/MS, GC, HPLC, A.A., microscopy and electroflorescence.

Laboratory space(s) for new equipment would have to be available of at the very least 400 - 500 sq. ft. in size and include air-conditioning and special ventilation.

v) Office space

To support the Forensic Science & Medicinal Chemistry programmes in the initial 5 year period, it is to be expected that upwards of 6 new faculty will
be hired. These faculty will require offices, which are presently not available or in existence.

Taking as minimum size of 100 sq. ft. per office, then at least 600 sq. ft of new faculty office space is required.

If, very conservatively, each new faculty member has 2 graduate students, then “office” space will have to be available for potentially 12 students ( and more). This does not take into account office space needs for post-doctoral students, visiting faculty and technical support personnel, which would be a natural outcome of the research support for the Forensic Science & Medicinal Chemistry programmes.

vi) Research laboratory space

The present Chemistry research laboratory space will be utilized initially as much as possible to accommodate the increase in research activity expected as an outcome of the Forensic Science & Medicinal Chemistry programmes. Based on current usage, it is evident that new facilities will be required. The addition of new research laboratory space(s) which would include fume hoods and all necessary infrastructure including air-conditioning and special ventilation is needed to support the expanding research base. Laboratory space of size 1000 sq. ft. might be sufficient initially. However, the research demands of the new faculty will drive the initial and on-going research laboratory space requirements in both size and design.

vii) Equipment and equipment upkeep

The Forensic Science & Medicinal Chemistry programmes are by design “hands-on” laboratory orientated in structure. There has to be a commitment of funds to purchase the modern instrumentation necessary for these programmes, both at the undergraduate teaching and research levels.

It is estimated that a commitment in the region of $365,000 to purchase the equipment would have to be made. This should provide a “basic” suite of instrumentation.

As both programmes progress & evolve, further commitment of funds would be required to build on the “basic” equipment.

Supplies for operating and upkeep of the equipment could require $10,000 to $15,000 per annum.
4. RELATIONSHIP TO OTHER PROGRAMMES AND INSTITUTIONS

4.1 Relationship to existing programmes in the same institution:

At present, there is no Forensic Science programme or course - undergraduate or graduate - within the University of New Brunswick system. Discussions have taken place with Deans of Arts at the University of New Brunswick - Saint John and representative faculty from the Criminal Justice Minor programme on the linkage of Forensic Science with the Criminal Justice Minor. The Deans of Arts are of the opinion that the establishment of forensic courses at University of New Brunswick - Saint John could not only enhance programme development in Science, but also in the Arts Faculty.

The coupling of the present Criminal Justice Minor with Forensic Science courses as electives could lead to a possible degree in Forensic Studies [especially if a topic such as forensic accounting could be added to the compliment of “forensic” courses].

This could lead to the possible establishment of two streams - a B.Sc. in Forensic Science and a B.A. in Forensic Studies.

[A further possibility might involve a link between Law and Forensic Science/Studies in a degree in Forensic Law.]

On the matter of “linkage”, with the course content being “broadly” science based, this Forensic programme would have the scope to link to other presently offered or proposed programmes at University of New Brunswick - Saint John in the Arts & Science Faculties.

There are similarities in course and year between this proposed Forensic Science programme and the Medicinal Chemistry programme proposed by the Department of Physical Sciences at the University of New Brunswick - Saint John:

**COURSES IN COMMON BETWEEN PROGRAMMES**

BIOL 1001/ 2065/ 2245/ 3132

CHEM 1041/ 1046/ 1072/ 1077/ 2111/ 2401/ 2416/ 2422/ 2457/ 3132/ 3401/ 3416/ 3422/
3437/ 3503/ 3641/ 3642/ 3647/ 4111/ 4132

MATH 1003/ 1013

PHYS 1000

PSYC 1003/ 1004/ 3752
STAT 2264

COURSE DIFFERENCES BETWEEN PROGRAMMES

<table>
<thead>
<tr>
<th>Medicinal Chemistry</th>
<th>Forensic Science</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1st year required</strong></td>
<td><strong>1st year required</strong></td>
</tr>
<tr>
<td>BIOL 2015</td>
<td>BIOL 1012/1017</td>
</tr>
<tr>
<td><strong>1st year elective</strong></td>
<td><strong>1st year elective</strong></td>
</tr>
<tr>
<td></td>
<td>ANTH 1002</td>
</tr>
<tr>
<td></td>
<td>HIST 1301</td>
</tr>
<tr>
<td></td>
<td>POLS 1001/1002</td>
</tr>
<tr>
<td></td>
<td>SOCI 1001</td>
</tr>
<tr>
<td></td>
<td>BIOL 1411/1416</td>
</tr>
<tr>
<td><strong>2nd year required</strong></td>
<td><strong>2nd year required</strong></td>
</tr>
<tr>
<td>PHIL 1053</td>
<td>SOCI 2611</td>
</tr>
<tr>
<td>CHEM 2611</td>
<td>SOCI 2614</td>
</tr>
<tr>
<td>CHEM 2632</td>
<td>CHEM 2201/2222/2237</td>
</tr>
<tr>
<td><strong>2nd year elective</strong></td>
<td><strong>2nd year elective</strong></td>
</tr>
<tr>
<td></td>
<td>ANTH 2502</td>
</tr>
<tr>
<td></td>
<td>PHIL 2124</td>
</tr>
<tr>
<td></td>
<td>PHYS 2975</td>
</tr>
<tr>
<td></td>
<td>SOCI 2603</td>
</tr>
<tr>
<td></td>
<td>CHEM 2601</td>
</tr>
<tr>
<td></td>
<td>CHEM 2622</td>
</tr>
<tr>
<td></td>
<td>CHEM 2637</td>
</tr>
<tr>
<td><strong>3rd &amp; 4th year required</strong></td>
<td><strong>3rd &amp; 4th year required</strong></td>
</tr>
<tr>
<td>CHEM 3315</td>
<td>FRNC 2701</td>
</tr>
<tr>
<td>CHEM 3316</td>
<td>FRNC 2702</td>
</tr>
<tr>
<td>PHIL 3133</td>
<td>FRNC 3701</td>
</tr>
<tr>
<td>CHEM 3701</td>
<td>FRNC 3702</td>
</tr>
<tr>
<td>CHEM 3702</td>
<td>FRNC 4700</td>
</tr>
</tbody>
</table>
The hiring of new and additional faculty and staff is a requirement for the implementation of this Forensic Science programme, as it is for the proposed Medicinal Chemistry programme. This hiring process will take place over the preliminary years of operation of both programmes, and extend beyond the initial 5 years of both programmes. In summary it is proposed that initially faculty and staff be hired in the subject areas:

<table>
<thead>
<tr>
<th>Medicinal Chemistry</th>
<th>Forensic Science</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year 1</td>
<td>Bio-organic Chemistry</td>
</tr>
<tr>
<td>Year 2</td>
<td>Medicinal Chemistry</td>
</tr>
<tr>
<td>Year 2/3</td>
<td>Physical Chemistry</td>
</tr>
<tr>
<td>Year 3</td>
<td>Technician</td>
</tr>
</tbody>
</table>

It is NOT proposed that there be duplication of the hiring of new faculty and staff in all subject areas for the implementation of the Forensic Science and Medicinal Chemistry programmes.

It is implied that there be linkage of teaching and support responsibilities between the two programmes.
programmes as much as possible (at least initially).
The physical chemist would deliver courses to both the proposed Forensic Science &
Medicinal Chemistry programmes.
By careful selection of the expertise of the other initial faculty hired, it would be possible
for that person to deliver courses to both programmes in such areas as medicinal chemistry
& toxicology.
The technician would support both programmes.

It is implicit that faculty will be hired in areas of subject expertise to broaden the course
base for the individual programmes in forensic science/chemistry and medicinal chemistry
both in the initial 5 year period and in subsequent years.

The projected instrumentation and library acquisition costs would be for the equipment
and library needs of both the Forensic Science and Medicinal Chemistry programmes.

If we take into consideration that there would be linkage between the Medicinal
Chemistry and Forensic Science programmes, then the 5 year combined resource
projections for faculty and staff, stipends, library acquisitions and equipment become:

<table>
<thead>
<tr>
<th></th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Faculty/staff</td>
<td>0</td>
<td>140000</td>
<td>330000</td>
<td>400000</td>
<td>400000</td>
</tr>
<tr>
<td>Stipends</td>
<td>7600</td>
<td>15 200</td>
<td>22800</td>
<td>22800</td>
<td>22800</td>
</tr>
<tr>
<td>Library acquisitions</td>
<td>65500</td>
<td>68000</td>
<td>68000</td>
<td>64000</td>
<td>64000</td>
</tr>
<tr>
<td>Equipment</td>
<td>25000</td>
<td>115000</td>
<td>75000</td>
<td>75000</td>
<td>75000</td>
</tr>
<tr>
<td>TOTAL</td>
<td>98100</td>
<td>338200</td>
<td>495800</td>
<td>561800</td>
<td>561800</td>
</tr>
</tbody>
</table>

In terms of the faculty/staff positions breakdown this would be:

<table>
<thead>
<tr>
<th></th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Forensic Chem</td>
<td>Forensic Chem</td>
<td>Forensic Chem</td>
<td>Forensic Chem</td>
</tr>
<tr>
<td></td>
<td>Medicinal/Toxicology Technician</td>
<td>Medicinal/Toxicology Technician</td>
<td>Medicinal/Toxicology Technician</td>
<td>Medicinal/Toxicology Technician</td>
</tr>
</tbody>
</table>

23
If a similar combination of the number of students projected for the linked Forensic Science and Medicinal Chemistry are presented as anticipated revenue for the **first 5 year period of implementation**:

<table>
<thead>
<tr>
<th></th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>New students in both programmes</td>
<td>25</td>
<td>40</td>
<td>52</td>
<td>62</td>
<td>62</td>
</tr>
<tr>
<td>Additional tuition revenue</td>
<td><strong>98625</strong></td>
<td><strong>157800</strong></td>
<td><strong>205140</strong></td>
<td><strong>244590</strong></td>
<td><strong>244590</strong></td>
</tr>
</tbody>
</table>

### 4.2 Comparison with other programmes in the Maritimes and in Canada:

The proposed Bachelor of Forensic Science at University of New Brunswick - Saint John would be the one of only a few of it's kind in Canada.

A double major in Forensic Science is offered at the University of Toronto - Erindale Campus. There the student majors in Chemistry, or Biology or Anthropology and takes Forensic Science as a second major.

St. Mary's University in Halifax has recently introduced a Diploma in Forensic Science. In the USA there are about a dozen undergraduate programmes that offer training in forensic sciences.

Trent University and the University of Windsor have recently introduced undergraduate programmes in Forensic Science.

Worldwide there are a further handful of undergraduate programmes - University of Technology, Sydney, Australia, and the University of Strathclyde, Scotland being two such programmes.

### 4.3 Collaboration with other institutions:

Since it's inception the proposal to implement this programme has been discussed with members of the staff at the Saint John and Rothesay Regional
Police Forces, and Office of the Coroner. It is to be hoped that specialists for the Saint John Regional Hospital (which is adjacent to the University of New Brunswick - Saint John campus) will be appointed as adjunct professor(s) at the University of New Brunswick - Saint John, and a member(s) of the administrative staff of the police forces and hospital will be placed on the programme advisory board.

4.4 Evidence of consultation

Copies of this document with a request for comments will be sent to Science Faculties at all Maritime Universities. The proposal has been circulated to the Office of the Coroner and the Chiefs of the Saint John and Rothesay Regional Police Forces.

5. PROGRAMME NEED

5.1 Social Need:

The forensic science “industries” in Canada, and North America place increasing demands for trained personnel at all levels of expertise, as evidenced by the number of advertisements in many Web-based sites on forensic science/studies Science graduates experienced in both theoretical and applied methods of understanding problems regarding forensic investigation and usage are required to fill such employment opportunities, either directly from an undergraduate programme such that proposed here, or through a graduate programme.

It is to be expected that those students that complete the proposed undergraduate programme would find easy acceptance into the forensic science “industry” and/or graduate school admission.

“...the ultimate role of the forensic scientist is to present expert testimony. A police officer investigating an incident will seek clarification of three issues:

1) Has a crime been committed?
2) If so, who is responsible?
3) If the responsible person has been traced is there enough evidence to charge the person and support a prosecution?

Forensic science can be expected to make a contribution to the clarification of all three issues. The duties of a forensic scientist can be identified as follows:
1) Examine material collected or submitted to provide information previously unknown or to corroborate information already available.
2) Provide the results of that examination in a report to enable the investigator to trace an offender or to corroborate other evidence to provide a case for presentation to a court.
3) Present verbal evidence to a court to assist in resolution of the issue as charged...

From “Crime Scene to Court: The Essentials of Forensic Science”
Ed. Peter White Publ. The Royal Society of Chemistry

5.2 Consultation with potential employers:

An advisory board with representatives from potential employers will be established and consulted during the development of this programme.
[Copies of the proposal have been circulated to the Coroner's Office and the Chiefs of the Saint John and Rothesay Regional Police Forces]

5.3 Institutional Priority:

Offering of this programme has a high priority within the Faculty and is consistent with the Campus commitment to applied science and health related programmes.

5.4 Student Demand:

In North America Forensic Science is largely a graduate programme. It is believed, however, that an undergraduate degree programme with specialization in Forensic Science is at this time very desirable. Apart from preparing students for careers in medicinal and pharmaceutical industry immediately upon graduation, such a programme will also provide an excellent background for entrance into health professional schools and prepare students for graduate work in a variety of fields.

It is expected that the proposed undergraduate degree will attract new students to the University of New Brunswick, those who wish to enter the forensic science/studies job-market, but do not feel that their interests are being met by a “traditional” BSc degree in biology or chemistry or biology-chemistry, as well as students who are preparing for research in various “forensic” professions.

5.5 Enrollment Limits:

Enrollment caps may be placed on individual courses to manage laboratory sizes, etc., however, no overall cap has been placed on the program.
6. PROGRAMME DEVELOPMENT PROCESS

6.1 Institutional programme development process:

The new programme will need to be approved by the normal Faculty Council, Senate and Board of Governors process. In addition, from an early stage the proposal was reviewed externally and potential employers and changes were made as appropriate following receipt of their feedback.

6.2 Response to external reviewers:

Various changes have been and will be made in response to comments from the external reviewers

APPENDIX Course Descriptions

ANTH 1002 Introduction to Paleo-anthropology 3ch (3C)
Paleo-anthropology draws on the sub-fields of biological anthropology and archaeology. This course presents ecological/evolutionary interpretations of changes in human physiology and culture since about 6 - 8 million years ago when the direct ancestors of modern humans became distinct from the direct ancestors of modern chimpanzees and gorillas.

ANTH 2502 Introduction to Biological Anthropology 3ch (2C 1L) W
An introduction to the field of biological anthropology, with an emphasis on genetics, evolution, paleo-anthropology, and primatology. Lecture/laboratory format.

ANTH 3340 Archaeological Lab School 6ch (3S 3L)
Introduces archaeological techniques used to analyse artifacts, bioarchaeological specimens, ecofacts and sediments through participation in a lab research project.
Prerequisite: 3ch of archaeology or permission of the instructor
ANTH 3350   Archaeological Field School 6ch (6L)
Introduction to archaeological field techniques - site survey, excavation, mapping, profiling and recording - through participation in a field research project.
Prerequisite: 3ch of archaeology or permission of instructor.

ANTH 3502 Medical Anthropology 3ch (3C) W
A cross-cultural study of human sickness and health from a biocultural point of view. Topics emphasized are: disease among non-human primates; medical history in the fossil record; adaptation and disease; ethnomedicine and the traditional healer; the influence of culture on human biology and disease.

ANTH 3522 Human Variation 3ch (3L) W
An examination of how and why people are different in their adaptability to varying environments. The emphasis is biocultural and the course includes such topics as disease, diet, environmental stress, growth and development, and demography.
Prerequisite: ANTH 2502

BIOL 1001 Biological Principles I 3ch (3C)
Introduces biological principles and processes. Considers the chemistry of life, maintenance of cells and organisms, energy utilization, genetic information, reproductive continuity and mechanisms of evolution.
Prerequisite: Grade 12 Chemistry and Grade 12 Physics or equivalent.

BIOL 1012 Biological Principles II 3ch (3C)
Surveys the structure, function and evolution of selected plants and animals. Topics include ecosystems and ecological interactions.

BIOL 1017 Applications in Biology 2ch (3L)
Instruction and laboratory work dealing with the applications of Biology at the level of organisms and the ecological interactions.
Prerequisite: BIOL 1001, Co-requisite: BIOL 1012

BIOL 1411 Anatomy & Physiology I 3ch (3C)
Basis concepts in human anatomy and physiology, with emphasis on the normal condition.
Prerequisite: Chem 122 and Biology 122. For Nursing students only, or permission of instructor.

BIOL 1412 Anatomy & Physiology II 3ch (3C)
A continuation of BIOL 1411, basic concepts in human anatomy and physiology, with emphasis on the normal condition.
Prerequisite: BIOL 1411, For Nursing students only, or permission of instructor.

**BIOL 1416 Anatomy & Physiology Laboratory I 2ch (3L)**
A selection of laboratory exercises to accompany BIOL 1411.
Co-requisite: BIOL 1411

**BIOL 1417 Anatomy & Physiology Laboratory II 2ch (3L)**
A selection of laboratory exercises to accompany BIOL 1412
Co-requisite: BIOL 1412

**BIOL 2065 Introductory Biochemistry 4 ch (3C 3L*)(W)**
Protein structure and function, techniques for protein analysis, examples of important proteins, mechanisms and regulations of enzymatic activity, metabolism (basic concepts and design, followed by the study of a few pathway).
Prerequisite: BIOL 1001.

**BIOL 2245 Introductory Molecular Cell Biology 4ch (3C 3L*)**
Studies cell membranes, motility and sensory systems; gene regulation and molecular embryology; DNA, RNA, protein synthesis, viruses and molecular genetics.
Prerequisite: BIOL 1001

**BIOL 2485 Introduction to Microbiology 4ch (3C 3L*)**
Covers the occurrence, distribution and importance of the major groups of bacteria; bacterial metabolism, growth, structure and function; introduces the role of microbes in the environment, microbial interactions, biological cycles and exploitation of microbes by industry. Labs stress techniques for observation, cultivation and characterization of bacteria and experimental concepts of the discipline.
Prerequisite: BIOL 1001

**BIOL 3132 Advanced Biochemistry 3 ch (3C)**
Metabolic energy, generation and storage, glycolysis, biosynthesis of nucleotides, structure, nucleic acids structure and manipulation, DNA replication, repair and recombination, transcription, the role of RNA, control of transcription in prokaryotes, translation, eukaryotic gene expression.
Prerequisite: BIOL 2065.

**CHEM 1041 General Chemistry I 3 ch (3C 1T)**
Introductory course designed primarily for BSc students.
Prerequisite: Grade 12 Chemistry or equivalent. Co-requisite: MATH 1003.
CHEM 1046  Introductory Chemistry Laboratory I  2 ch (3L)
A selection of experiments to accompany CHEM 1041.
Co-requisite: CHEM 1041 or equivalent.

CHEM 1072  General Chemistry II  3 ch (3C 1T)
A continuation of CHEM 1041.
Prerequisite: CHEM 1041. Co-requisite: MATH 1013 or MATH 1003 repeated.

CHEM 1077  Introductory Chemistry Laboratory II  2 ch (3L)
A selection of experiments to accompany CHEM 1072.
Prerequisite: CHEM 1046 or equivalent. Co-requisite: CHEM 1072.

CHEM 2111  Introductory Analytical Chemistry  5 ch (3C 3L)
Theory and practice. Topics include concepts of acid-base, redox, precipitation and solvent extraction equilibria; sample handling and preparation; calibration techniques; error analysis and regression analysis; titrimetric and spectrophotometric analysis.
Prerequisites: CHEM 1072/1077.

CHEM 2201  Introduction to Inorganic Chemistry I  3ch (3C)
Bonding, structures and reactions of compounds of both main group and transition elements.
Prerequisite: CHEM 1041 and CHEM 1072 (D grade not acceptable)

CHEM 2222  Introduction to Inorganic Chemistry II  3ch (3C)
Bonding, structure and reactions of compounds of both main group and transition elements.
Prerequisite: CHEM 2201.

CHEM 2237  Inorganic Chemistry Laboratory  2 ch (3L)(W)
Preparation, analysis, structural determination of inorganic compounds.
Prerequisites: CHEM 1041/1046, 1072/1077 and CHEM 2201. Co-requisite: CHEM 2222.

CHEM 2401  Organic Chemistry I  3 ch (3C)
An introductory course. Topics include structure and bonding, stereochemistry of alkanes and cycloalkanes, conformational analysis of cyclohexane, functional groups, structure determination, reactions of alkenes and alkynes, introduction to organic reactions.
Prerequisite: CHEM 1072.

CHEM 2416  Organic Chemistry Laboratory I  2 ch (3L)(W)
Introduction to experimental (organic) chemistry. Part I.
Prerequisite: CHEM 1072/1077. Co-requisite: CHEM 2401.

CHEM 2422  Organic Chemistry I  3 ch (3C)
A continuation of CHEM 2401. Topics include stereochemistry, optical isomerism, alkyl halides, nucleophilic substitution and elimination reactions and their synthetic utility, brief introduction ot
spectroscopic methods, benzene and aromaticity, alcohols and phenols, preview of carbonyl compounds.
Prerequisite: CHEM 2401.

**CHEM 2457 Organic Chemistry Laboratory 2 ch (3L)(W)**
A laboratory course involving synthesis and purification of organic compounds, stereochemistry, isolation and structure elucidation of natural compounds (by both qualitative and spectroscopic methods).
Prerequisite: CHEM 2416. Co-requisite CHEM 2422.

**CHEM 2601 Chemical Thermodynamics 3 ch (3C)**
The three laws of thermodynamics, thermochemical calculations, chemical equilibria, introduction to phase rule.
Prerequisites: CHEM 1072 and MATH 1003/1013. Co-requisite: MATH 2503 or equivalent.

**CHEM 2622 Electrochemistry and Chemical Kinetics 3 ch (3C)**
Elementary electrochemistry, electrochemical cells, electrolysis, electromotive forces, applications of EMF measurements. Reaction kinetics and mechanisms, uni-, bi-, and ter-molecular reactions, catalysis, enzyme catalysis, chain reactions, reaction dynamics, steric effects and transition state theory.
Prerequisite: CHEM 2601. Co-requisite: MATH 2513 or equivalent.

**CHEM 2637 Physical Chemistry Laboratory 2 ch (3L)**
Introduction to experimental physical chemistry.
Prerequisite: CHEM 1077. Co-requisite: CHEM 2622.

**CHEM 3132 Intermediate Analytical Chemistry 5ch (3C/3L)**
Principles and applications of “wet” methods and instrumental analysis, sample preparation, clean up and method development. Topics include non-aqueous titrations, complexometric titrations, analytical extractions and separations, potentiometry, analytical spectrophotometry, gas chromatography, and elementary chemometrics
Prerequisites: CHEM 2111

**CHEM 3202 Advanced Inorganic Chemistry I 3 ch (3C)**
Structure and chemistry of both main groups and transition metals and their compounds.
Prerequisites: CHEM 2201 and CHEM 2222 (D grade not acceptable).

**CHEM 3221 Advanced Inorganic Chemistry II 3ch (3C)**
Structure and chemistry of both main group and transition metals and their compounds.
Prerequisites: CHEM 2201, CHEM 2222 and CHEM 3202 (D grade not acceptable).
CHEM 3236 Advanced Inorganic Chemistry Laboratory 2 ch (3L)(W)
Preparative, analytical, and instrumental techniques in main group and transition metal, inorganic, organometallic and coordination chemistry.
Prerequisite: CHEM 2237. Co-requisite: CHEM 3202.

CHEM 3401 Organic Chemistry III 3 ch (3C)
Spectroscopic methods in organic chemistry, background and applications to structure determination: NMR, IR, Mass Spectrometry, conjugated dienes, UV, CD.
Prerequisite: CHEM 2422.

CHEM 3416 Organic Chemistry Laboratory 2 ch (4L)
Introduction to organic synthesis. Application of UV, IR, and NMR spectroscopy..
Prerequisite: CHEM 2411. Co-requisite: CHEM 3401.

CHEM 3422 Organic Chemistry IV 3 ch (3C)
Chemistry of carbonyl group, carbanion chemistry, chemistry of enols and enolates, pericyclic reactions, aromatic substitution, biomolecules: carbohydrates and amino acids. Organic synthesis, special topics.
Prerequisite: CHEM 3401.

CHEM 3437 Organic Chemistry Laboratory 2 ch (4L)
Resolution of enantiomers; advanced synthetic methods - Grignard, Diels-Alder, Wittig, Biotransformations etc.
Prerequisite: CHEM 2416. Co-requisite: CHEM 3422.

CHEM 3503 Bio-organic Chemistry of Nucleic Acids 3ch (3C) (W)
Structure, properties and chemistry of nucleic acids (DNA & RNA). Chemical synthesis. Unusual DNA structures. Modern probes of DNA structure, DNA binding and cleaving agents, protein-DNA interactions and other aspects of DNA recognition. Chemical mutagens and carcinogenicity. The chemical aspects of modern biochemistry tools(synthesis, sequencing, cloning, etc) will also be covered.
Prerequisites: BIOL 2065 and BIOL 2245, Co-requisites: CHEM 3401 and CHEM 3422

CHEM 3523 Bio-organic Chemistry of Proteins 3ch (3C) (W)
co-enzymes, drug enzyme interactions, rational design of enzyme inhibitors. Chemical aspects of modern protein chemistry tools (sequencing, synthesis, etc.). Protein engineering, catalytic antibodies, ribozymes and catalytic RNA.

Prerequisites: BIOL 2065 and BIOL 2245, Co-requisites: CHEM 3401 and CHEM 3422

**CHEM 3641 Physical Organic Chemistry I 3ch (3C)**


Prerequisites: CHEM 2601 and CHEM 2622

**CHEM 3642 Physical Organic Chemistry II 3ch (3C)**

Continuation of topics in CHEM 3641. Inclusion of statistical thermodynamics & theories of reaction rates.

Prerequisite: CHEM 3641

**CHEM 3647 Physical Organic Chemistry Laboratory 2ch (3L) (W)**

Spectroscopic techniques and applications in ultra-violet, visible, infrared and nuclear magnetic resonance areas.

Prerequisite: CHEM 2637, Co-requisite: CHEM 3641

**CHEM 4111 Instrumental Analytical Chemistry I 3ch (2C/2L)**

A coordinated laboratory-lecture course to introduce the principles of instrumental analysis, operational aspects of analytical spectroscopy and chromatography.

Prerequisites: CHEM 3132

**CHEM 4132 Instrumental Analytical Chemistry II 3ch (2C/2L)**

A coordinated laboratory-lecture course to introduce the principles of electroanalytical methods, differential thermal analysis, concepts of signal/noise, simple chemometric methods for data enhancement and aspects of instrumentation.

Prerequisite: CHEM 4111

**CHEM 4422 Advanced Organic Chemistry 3ch (3C)**

The organic chemistry of drug synthesis. Advanced topics in organic chemistry such as synthesis of complex, polyfunctional molecules, asymmetric synthesis.

**FRNC 2701 Forensic Science I Principles of Forensic Science 3ch**

This provides a broad overview of forensic science. It is designed to introduce the different disciplines, principles and concepts peculiar to forensic science. It covers, in the forensic context, the following areas: history, general definitions and concepts, sub-disciplines,
methodology and methods, introduction to crime scene, trace typology, function of expert, legal system, judicial admissibility, ethical considerations, interpretation of forensic evidence.

**FRNC 2702 Forensic Science II Forensic Imaging 3ch**
Covers application of light theory in forensic science (absorption, reflection, UV, IR, diffusion, episcopic coaxial illumination, polarised light, photoluminescence etc), technical and forensic photography (use of large and medium format and single lens reflex cameras), image treatment, optical and electron microscopy, comparison microscopy.

**FRNC 3701 Forensic Science III Forensic Toxicology I 3ch**
An introduction to the fundamentals of forensic toxicology. It involves specific forensic material, general pharmacology and toxicology. The subject also gives an overview of Provincial & Federal laws concerning licit and illicit drugs & poisons.

**FRNC 3702 Forensic Science IV Forensic Toxicology II 3ch**
An advanced course dealing in some depth with analytical details of the areas covered. The course enables the pharmacology and toxicology of drugs such as cannabis, amphetamines, opiates and cocaine to be taught on parallel with other aspects of these drugs.

**FRNC 4700 Honours Research Project in Forensic Science 6ch**
Project in forensic chemistry involving literature search and laboratory work; a work term, or internship on a crime or forensic laboratory.

**FRNC 4701/4702/4705 Forensic Science V/VI/VII Selected Topics in Forensic Science 9ch**
Forensic cases from chemical & legal standpoints - specialists in forensic science could lecture on a variety of topics including crime scene investigation, the role of the coroner, forensic pathology, forensic botany, forensic entomology, forensic dentistry, psychology and toxicology.

**HIST 1301 Canadian Historical Issues 3ch (3L)**
This course is designed to introduce students to methodology and techniques of historical study. It will focus on the historical background to current issues in Canadian society, culture and politics.

**HIST 3386 Canadian Criminal Justice System 3ch**
An examination of the Canadian criminal justice system with an emphasis on criminal law, courts, police and corrections from the colonial era to the mid-twentieth century.
Prerequisite: HIST 1301 or equivalent

**MATH 1003 Introduction to Calculus I 3 ch (4C)**
Functions and graphs, limits, derivatives of polynomial, log, exponential and trigonometric functions. Curve sketching and extrema of functions.
Prerequisite: New Brunswick Advanced Math 120 or MATH 1863 or its equivalent. Note: Credit will not be given for both MATH 1003 AND 1823.

**MATH 1013 Introduction to Calculus II 3 ch (4C)**
Prerequisite: A grade of C or higher in either MATH 1003 or 1823.

**PHIL 2124 Contemporary Moral Problems 3ch (3C)**
A wide-ranging look at a variety of claims and issues perplexing moral agents in contemporary society.

**PHYS 1000 Elements of Physics 9 ch (3C 1T 3L/S)**
Prerequisite: Grade 12 Physics or equivalent. Co-requisite: MATH 1003/1013.

**PHYS 2975 Light and Sound 5ch (3C 3L)**
Periodic motions and their linear superpositions, free and forced damped harmonic motion, resonance, normal modes, vibrating strings. Transverse and longitudinal waves in various media, acoustics, reflection and refraction of waves at boundaries. Topics selected from the following list: geometrical optics, interference, diffraction, polarization, wave-particle duality, dispersion, coherence.
Prerequisites: MATH 1003/1013 Corequisite: MATH 2513

**POLS 1201 Introduction to Canadian Politics 3ch (3C/T)**
Survey course focusing on Canadian government and politics at the national level.
PSYC 1003. Introductory Psychology I 3 ch (3C)
An overview of psychology as well as an introduction to the biological basis of behavior, motivation, learning, sensation, perception, memory, thinking and language. Students may be requested to participate in research and some course credit may be earned in this way.

PSYC 1004 Introductory Psychology II 3 ch (3C)
Examines social behaviour, personality, assessment, abnormal psychology, and psychological therapy. Students may be requested to participate in research and some course credit may be earned in this way.

PSYC 3263 The Psychology of Criminal Behaviour 3ch
Examines psychological contributions to theories of crime and incarceration and addresses specific topics such as: how media and political forces affect criminal justice policies; the effectiveness of offender treatment and punishment programmes; the prevention of crime; the effects of incarceration on prisoners; the prediction of criminal behaviour.

PYSC 3313 Introduction to Psychological Testing 3ch (3C/L)
An introduction to principles pf psychological testing as they arise in consideration of relevant statistical concepts and methods and of historical experience in development and use of tests for general intelligence, differential abilities and personality traits. Prerequisite: PSYC 2102

PSYC 3493 Changing Behaviour 3ch (1C 2S)
An examination of the application of basic principles of learning to human behavioural processes. A study of the treatment techniques and assessment procedures employed in behaviour modification programs.

PSYC 3553 Abnormal Psychology 3ch (3C/S)
This course will provide the student with a comprehensive picture of maladaptive behaviour from a biological and psychosocial perspective. Problems associated with diagnostic systems, the role of stress, and other causative factors implicated in the traditional clinical syndromes will be discussed.

PSYC 3752 Drugs and Behaviour 3ch (3C/L)
A survey of all classes of psychoactive drugs, their effects on human and animal physiology and behaviour, their history of use, and various drug related issues such as abuse, dependency, and legality.

SOCI 1001 Introduction to Sociology 3ch (3C)
Surveys the basic concepts, theories and analytical methods of sociology and introduces students
to sociology as a way of thinking.

**SOCI 2603 Sociology of Deviance 3ch (3C)**
Examines the elements and patterns of deviance, basic principles of both normative and deviant behaviour, and the institutionalization of each. Studies examples of specific areas and types of deviance in some detail.

**SOCI 2611 Qualitative Criminology I 3ch**
Introduces students to the field of qualitative criminology. Focuses on criminological developments since the work of Becker in the 1950s. Emphasis will be placed on interactionist, ethnomethodological, feminist and other micro-level analyses of crime in Western societies.

**SOCI 2614 Qualitative Criminology II 3ch**
Advanced study in the field of qualitative criminology. Focuses on developments in the field since the emergence of the New Criminology in the 1970s. Emphasis will be placed on Marxist, post-structuralist and other macro-level analyses of crime in Western societies. Prerequisite: SOCI 2611

**SOCI 3610 Criminology 6ch (3C) W**
A basic course consisting of an examination of the historical development of criminological theory, and the causes of crime and the methods of investigation into criminal behaviour.

**SOCI 3611 Socio-legal Studies 3ch**
Examines the complex relations between law and Western societies. Emphasis will be qualitative, historical and critical interpretations of the field. Wherever possible, empirical analysis will be used to highlight theoretical concerns. Prerequisite: SOCI 2614

**SOCI 3700 Studies in Urban Sociology 6ch (3C)**
Analyzes the evolution and structure of the urban community as a socio-spatial system. An introduction to the study of urban social and ecological structure, with particular attention given to the Canadian urban system.

**SOCI 3901 Sociology of Policing 3ch**
Examines the evolution of policing and police forces throughout the past century, recent changes in the nature of urban and rural policing, police-minority groups interaction, new initiatives in modes of policing, and the impact of technology.
SOCI 4603  Special Topics in Criminological Theory

3ch
Intensive examination of selected recent developments in the field with an emphasis on feminist, critical, post-structural and interactionist literature.
Prerequisite: SOCI 2614

SOCI 4613 Selected Topics in Socio-Legal Studies

3ch
In depth examination of selected topics in the field. Theoretical emphases will vary from year to year, but insights from phenomenological, ethnomethodological, post-structural, feminist and other discursive approaches will be stressed. Substantive topics also vary from year to year, but historical and contemporary concerns regarding social rights and welfare law will be prioritized.
Prerequisite: SOCI 3611

STAT 2264  Statistics for Biology I  3ch (3C)
An introductory course in statistics. Probability; Bayes’ Theorem, application of probability to genetics; random variable, expectation, binomial and normal random variables; confidence intervals for means and proportions; prediction intervals, test of hypotheses; paired data vs two independent samples. Brief introduction to analysis of variance; regression, correlation; contingency variables, examples drawn from biology. Use of statistical computer package.
Prerequisite: New Brunswick Mathematics 112 and 122 or equivalent.

STAT 3264  Statistics for Biology II 3ch (3C)
Experimental design, analysis of variance, regression, non-parametric statistics, the use of BMDP, SAS or SPSS computer packages.
Prerequisite: STAT 2264.