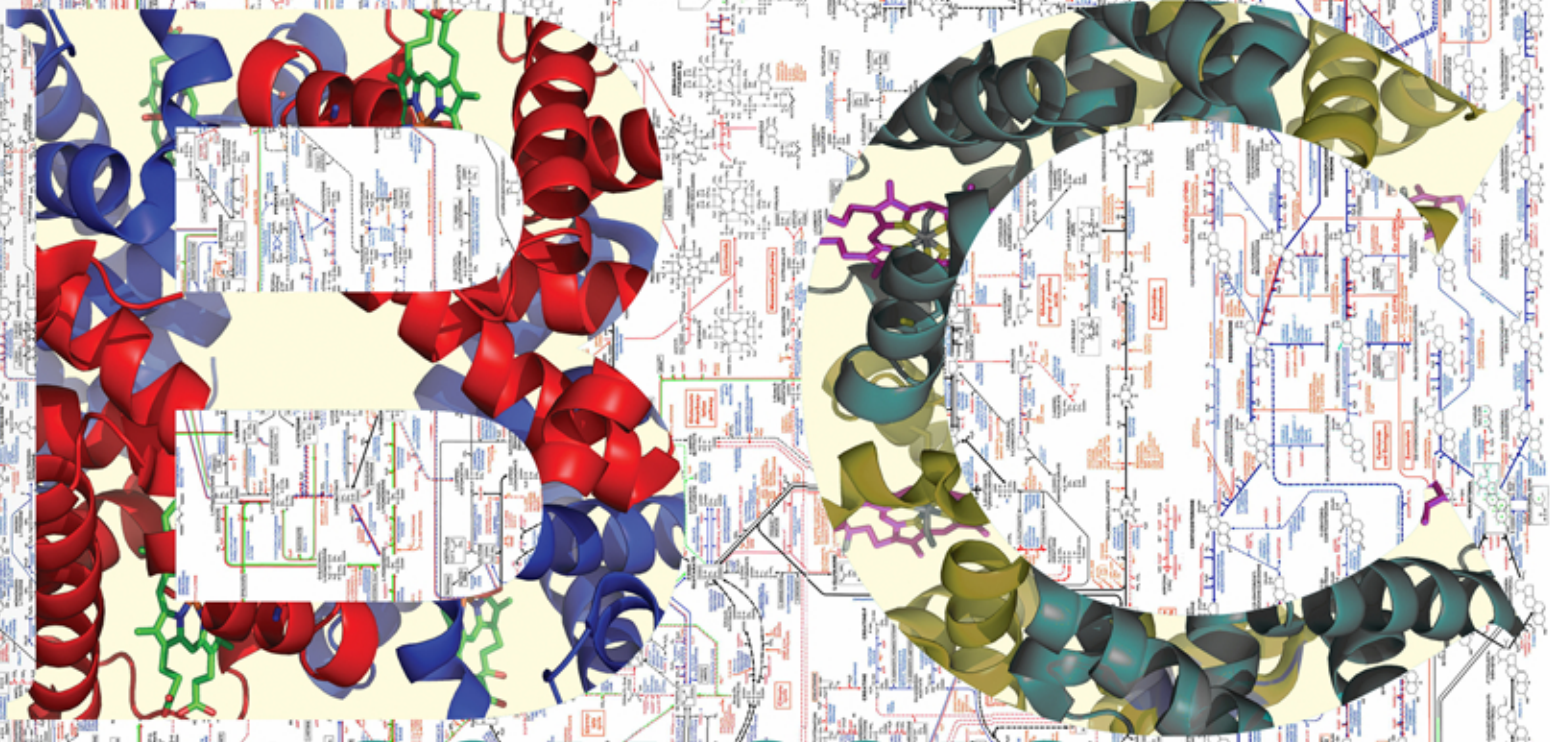
BIOCHEMISTRY

UNDERGRADUATE HANDBOOK



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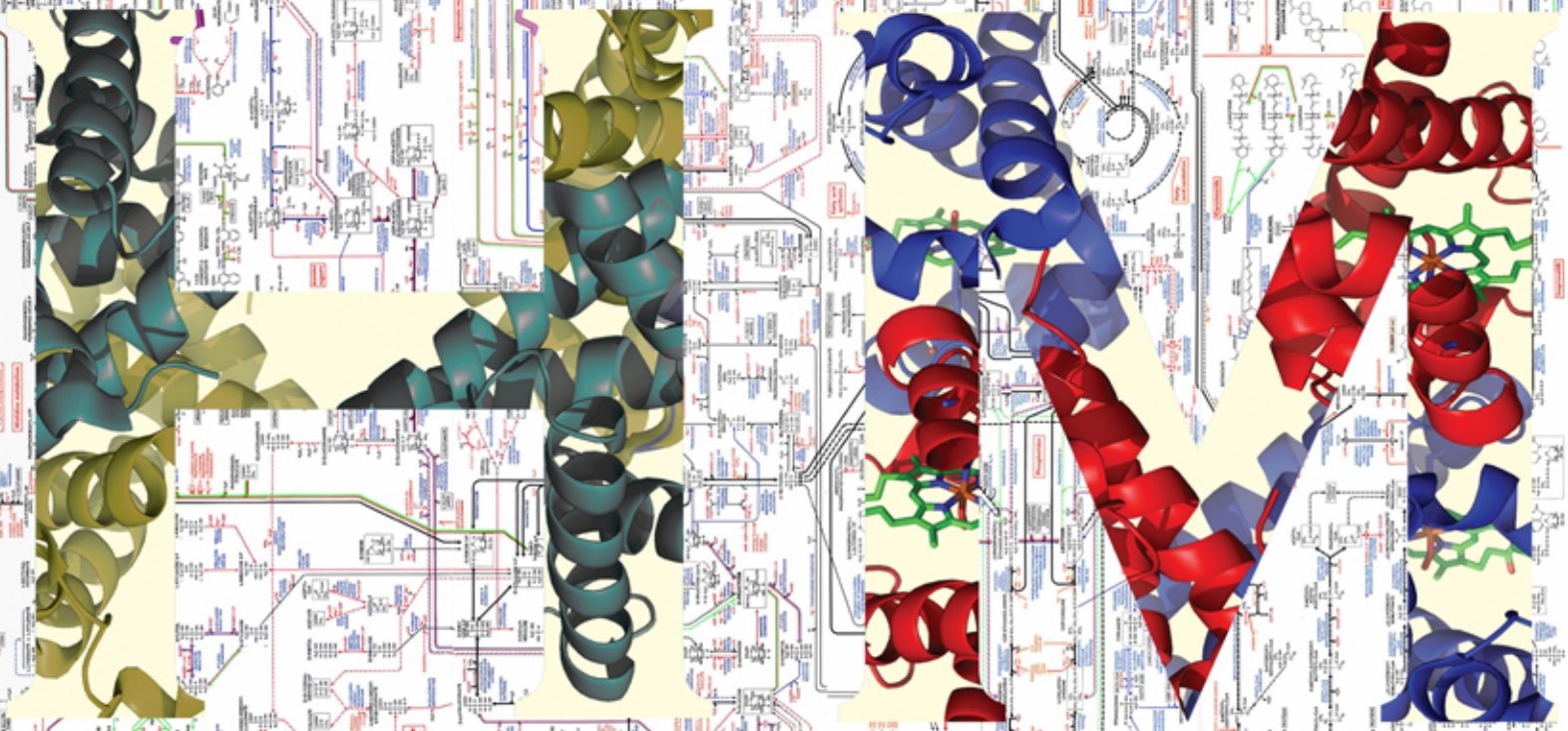

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UNDERGRADUATE HANDBOOK 2011-2012

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A Message from the Chairs of Chemistry and Biology

Welcome to Biochemistry!

In a way, Biochemistry is a young science but an old art, as old as cooking, as beer or wine. The science emerged in more modern times, as biologists became more and more interested in the molecular make-up of living things and chemists applied their ever-improving craft to the growing class of the special molecules produced by cells. Appropriately, beer and wine played a large part in the birth of Biochemistry. Perhaps the first glint of the new paradigm of the cell as molecular machine came in 1833 when the French chemist Payen, who developed ways to refine starch and alcohol from potatoes for commercial purposes, discovered the first enzyme (amylase), fittingly a starch-hydrolyzing enzyme crucial in the conversion of grain to beer. Pasteur connected fermentation with yeast multiplication in 1857. The Danish brewer Carlsberg set up a laboratory in 1875 and kick-started the modern science with new ideas like pH and with advances in protein science, and Buchner (1907 Nobel Prize) found that fermentation could proceed outside a cell, with a yeast extract he called zymase, and so put to rest the vitalist ideas about brewing and Life in general. Thus began the quest to understand the nature and interplay of biological molecules. And thus began Biochemistry.

Landmark discoveries followed in rapid succession, including the proof that proteins and enzymes are macromolecules by Svedberg (1926 Nobel Prize) with the advent of ultracentrifugation, the elucidation of the metabolic cycle – one that gets stalled during anaerobic fermentation – by Krebs (1953 Nobel Prize), or the deciphering of the genetic code and its connection to protein synthesis by Khorana (1968 Nobel Prize). At the same time, we cannot forget the many other significant events, such as the elucidation of the structure of DNA (1962 Nobel Prize) and the advent of PCR (1993 Nobel Prize), that gave birth to what we call molecular biology, the important advances in nucleic acid isolation, identification, mode of action and exploitation.

It is fitting, therefore, that the Departments of Biology and Chemistry at York came together to create the Biochemistry degree program, which welcomed its first students in 2003. As co-administrators of this program, let us offer you our help in making your undergraduate career a rewarding and enriching experience. This handbook and the Biochemistry website (*www.biochem.yorku.ca*) are dedicated to helping you understand the program and the courses that are available to you, and to help guide you throughout your undergraduate career.

Biochemistry has captivated generations of students, and our faculty are no exception. We invite you to make full use of what we offer, and to join us in this exciting and rewarding discipline!

Imogen Coe, Chair of Biology

Jochen Rudolph, Chair of Chemistry

Why do Biochemistry at York?

- York has dedicated and experienced faculty members whose research interests are in Biochemistry and Molecular Biology, as well as in applied areas, including medically relevant areas.
- Students at York enjoy relatively small classes, engaging and approachable faculty, useful tutorials, relevant laboratory experience and modern equipment in a friendly atmosphere.
- The learning atmosphere is excellent, with plenty of opportunity to interact with our faculty, culminating with a research project course in the graduating year in which students gain valuable experience in the laboratory of a faculty member, working on an exciting research project.
- York graduates are successful. They get meaningful and well paid jobs in research, in industry and in teaching. Others go on to pursue graduate studies, here and at other prestigious universities in Canada and abroad. Many enter professional schools in medicine, dentistry, pharmacy, law and business.

Admission Requirements

The admissions requirements, beyond the general requirements of six completed courses at high school, are,

under the OAC system: ENGL, CALC, CHEM, PHYS

as of 2008-09: ENG4U, MHF4U, MCV4U, SCH4U, SPH4U

Enrolment in the program will be limited with the result that only high school graduates with "A" level standing will be considered for admission. Students who are not accepted at first may enrol in Biology or in Chemistry or as an Unspecified Major initially and apply for entry to Honours Biochemistry if their academic performance meets the program standards, if there is space available and if the study plan chosen is consistent with the program requirements.

Advising

- Advising for new students is conducted by the Faculty of Science and Engineering in summer and early fall. Consult the Student Academic Services office (355 Lumbers) to book an appointment.
- Advising for continuing students will take place in summer (consult *www.chem.yorku.ca/ugrad/Choices/BookAdvisingBCHM.htm*).
- One-on-one advice on program and course selections is always available from Prof. Potvin, acting advisor for Biochemistry, by appointment through the Chemistry main office (124 CB, 416-736-5246 or *chemasst@yorku.ca*). There is also an on-line tool to help you keep track of your academic progress (see *www.chem.yorku.ca/ugrad/Advising/ChooseRecord.htm*).

The Biochemistry Program – Specialized Honours BSc Degree in Biochemistry

Description

The Specialized Honours (120-credit) BSc Degree is the only program in biochemistry offered at York University. It is a four-year honours program with minimum gpa requirements for continuation and graduation (see p. 8). Depending on course selection, the program has the equivalent of 31-40 CHEM credits and 47-56 BIOL credits, some of which are listed as BCHM courses cross-listed with CHEM or BIOL courses. Students will get a strong foundation in both Chemistry and Biology but with a predominance of biochemical topics beyond first year. As well, the program requires first-year courses in Physics, Mathematics and Computer Science and General Education courses in Humanities and/or Social Sciences (refer to page 29).
Full program requirements are given on page 13.
This degree is suitable for pursuits at the graduate level, as well as for entrance into professional schools in the health sector (medicine, dentistry, etc.), law or business, or for teaching at elementary and secondary levels.

Program Alternatives

Students interested in Biochemistry but not wishing a specialization in Biochemistry have several choices. They can instead choose to earn an Honours Double Major degree combining CHEM and BIOL. This avenue provides more flexibility in course choices while still involving at least 36 BIOL credits and 37-38 CHEM credits, depending on the year you enter the program and on course selections, but has a higher gpa requirement than the Specialized Honours degree in Biochemistry (the minimum cumulative gpa over all SC courses is 6.0 for this combination).

For students wishing more emphasis in Chemistry, alternative choices are:

The Pharmaceutical & Biological Chemistry stream of the Specialized Honours BSc in Chemistry, with 18 or more credits in BIOL/BCHM courses. The requirements over the first two years of the Pharmaceutical & Biological Chemistry stream are nearly identical to those for the first two years of the Specialized Honours Biochemistry degree, for easy transferability. This option includes a 4th-year Research Project course. The minimum gpa is 5.5 (for students starting in Fall 2009 or later).

The Honours Major/Minor degree with a major in Chemistry and a minor in Biology, which requires 30 or more BIOL credits (which can include BCHM courses cross-listed with BIOL) and 56 credits in CHEM courses (which can include BCHM courses cross-listed with CHEM). This Major-Minor combination imposes a number of CHEM and BIOL courses (or BCHM equivalents) in the first two years, but allows considerable freedom in choosing courses in the upper years. There are space limitations in some upper-year BCHM courses, so consult with an advisor on your course choices. This option does not require a 4th-year Research Project course. The minimum gpa is 5.0.

The Honours Major BSc in Chemistry is ideal for those students interested in an Honours (120-credit) degree who wish to develop a Major in Chemistry with considerable freedom to choose courses (to possibly include BCHM credits cross-listed with CHEM courses) but with less specialization than in the full Specialized Honours Chemistry program and without needing to match it with a Major or a Minor in Biology (or in any other subject). This provides a student with the opportunity to take Chemistry, Biochemistry and Biology courses with the flexibility to add several courses from another discipline or from a combination of other disciplines, for instance to prepare for professional schools or to develop several subjects for teaching. This option does not require a 4th-year Research Project (since Fall 2009). The minimum gpa is 5.0.

Some of these degree programs may be suitable preparation for graduate studies in Chemistry, in Biochemistry, or in an interdisciplinary area, depending on the courses selected. Detailed information on these program choices is available from the Chemistry web site (*www.chem.yorku.ca*).

For students wishing more emphasis in Biology, alternative choices are

The Biotechnology stream of the Specialized Honours BSc in Biology is a rigorous blend of biochemical topics with computer science, economics, business, and ethics, designed to prepare graduates for careers in biotechnology, as well as for graduate studies and professional programs in law, business and health sciences. The program includes 58 credits of BIOL courses, many of which are also cross-listed as BCHM courses, as well as 23 credits of CHEM courses.

The Biomedical Science stream of the Specialized Honours or Honous Major BSc in Biology is for students who have a particular interest in biology, human health, and medical research. It calls for just a few Chemistry courses, consisting primarily of BIOL courses (minimum 51 credits for the Specialized Honours degree, 68 for the Honours Major degree), including some cross-listed with BCHM and CHEM courses.

The Honours Major/Minor degree with a major in Biology and a minor in Chemistry, which requires 51 credits of BIOL courses (which can include BCHM courses cross-listed with BIOL) and 30 or more CHEM credits (which can include BCHM courses cross-listed with CHEM).

The Honours Major BSc in Biology is ideal for those students interested in an Honours (120-credit) degree who wish to develop a Major in Biology (51 credits) with considerable freedom to choose courses (to possibly include BCHM credits cross-listed with BIOL courses) but with less specialization than in the full Specialized Honours Biology program and without needing to match it with a Major or a Minor in Chemistry (or in any other subject). This provides a student with the opportunity to take Chemistry, Biochemistry and Biology courses with the flexibility to add several courses from another discipline or from a combination of other disciplines, for instance to prepare for professional schools or to develop several subjects for teaching.

These Biology-rich Honours degree programs all have a higher gpa requirement than does the Specialized Honours degree in Biochemistry (the minimum cumulative gpa over all BIOL courses is 6.0). They also feature 3- or 8-credit Research Project courses in the 4th year. Some of these degree programs may be suitable preparation for graduate studies, particularly in Biochemistry, in Biology or in an interdisciplinary area, depending on the courses selected. Detailed information on these program choices is available from the Undergraduate Biology web site (*www.yorku.ca/ugbiol*).

Important Notes

Changes from 2010-11

The Department of Biology is reorganizing its 2000-level biochemistry and genetics courses effective Fall 2011. Prior to 2011-12, BCHM/BIOL 2020, 2021 and BIOL 2040 were 4-credit courses. Now, the lab components of these three courses are removed from these courses and are grouped into a new, 3-credit lab-only course, BIOL 2070 3.0. At the same time, the current 4-credit courses have become 3-credit courses. As of Fall 2011, only the 3-credit courses will be offered. Degree requirements currently requiring BCHM/CHEM 2020 4.0, BCHM/BIOL 2021 4.0 and BIOL 2040 4.0 will now require BCHM/CHEM 2020 3.0, BCHM/BIOL 2021 3.0, BIOL 2040 3.0 and BIOL 2070 3.0.

If you have already taken (by Fall 2011) the 4-credit versions of all of these courses, then you need do nothing. This change concerns you only if you have *not* completed all three of these 4-credit courses. Use the following Chart to determine what courses you must now take to complete your degree requirements.

	old courses				new courses			
	BCHM 2020 4.0	BCHM 2021 4.0	BIOL 2040 4.0		BCHM 2020 3.0	BCHM 2021 3.0	BIOL 2040 3.0	BIOL 2070 3.0
If you have already completed	✓	✓	✓	then you need to do the following	nothing – you're done			
	✓					✓	✓	✓
	✓	✓					✓	
	✓		✓			✓		
			✓		✓	✓		✓
	none of the above				✓	✓	✓	✓

Organization: Credits & Timing

The Faculty of Science and Engineering operates on a credit system which introduces flexibility into the timing of an individual student's program. The plan of Biochemistry instruction is such that the order in which courses are taken may be an important consideration. Thus, most of the courses have prerequisites which must be successfully completed first and/or corequisites which must be taken either at the same time or successfully completed earlier. Prerequisites and corequisites are listed with the course descriptions. Course directors have the prerogative of their enforcement. If a student enrols in a course for which they do not have the appropriate requisite course(s), the Course Director may have that student de-enrolled without prior notification to the student. However, the Course Director may grant permission to enrol into a course to students who lack pre/co-requisite course(s).

The prescribed selections of courses in any program are based on a 3-year (for the BSc degree) or 4-year program duration (for Honours BSc degrees), at an average 30-credit-per-year course load in the normal (8-month) academic year (Fall and Winter terms). The programming of course offerings assumes that years of study are recognizable (second year, third year, fourth year) and the course numbering reflects the normal progression. However, it is possible to take some 4000-level courses in year 3, or any 3000-level course in year 4, and so on. Importantly, the time-tabling of lectures, tutorials and laboratory periods has been carried out

accordingly, so as to avoid conflicts between courses in the same year of study. Students should bear in mind that it may not be possible to avoid timetable conflicts with "out-of-year" courses. Some courses are available in summer terms to alleviate Fall-Winter course loads.

Organization: Course Sequencing

The Biochemistry program is constructed so that if any required course has a prerequisite, the prerequisite is also required. If a course is not required, it may be selected as an elective course, in which case any prerequisite will need to be fulfilled first.

A Prerequisite Chart is included in this handbook (see p. 15), listing courses, both required and elective, and their prerequisites. This handbook also lists the many available elective courses that require no prerequisites that are not already part of the program (see p. 23). This can help you organize your course selection and brings out some timing considerations that should be kept in mind:

Students should strive to not delay SC/BCHM 2020 3.0/4.0, SC/BCHM 2021 3.0/4.0 or SC/BIOL 2040 3.0/4.0 to their third year, since this will delay their ability to take later required courses in a timely manner (see below) and prevent them from finishing in four years. Furthermore, a delay may incur scheduling conflicts, since courses are scheduled to not conflict with other courses of the same year level but not with courses at other levels, and will make registration in certain limited-enrolment courses more difficult (see below). Therefore, it is equally imperative that the prerequisites to 2000-level BCHM and BIOL courses, SC/BIOL 1000 3.0 and SC/BIOL 1001 3.0 (or SC/BIOL 1010 6.0) as well as SC/CHEM 1000 3.0 and SC/CHEM 1001 3.0, be taken in first year.

If you wish to take the required Advanced Biochemistry course (SC/BCHM 3010 3.00) in your third year, or if you wish to take the Pharmaceutical Discovery course (as SC/BCHM/BIOL/CHEM 3071 3.00) as an elective in your third year, you should take the prerequisites SC/CHEM 2020 and SC/BCHM 2020 3.0/4.0 in your second year. Since neither SC/BCHM 3010 3.00 nor SC/CHEM 3071 3.00 is prerequisite to any other courses, you may instead choose to take them in your fourth year. However, the Pharmaceutical Discovery course is usually available every year, but this is not guaranteed. If you plan on taking it as an elective, plan on being able to take it in your third year (with the possibility of delaying it to your fourth year), in which case you should plan on taking all prerequisites prior to your third year.

Similarly, the required Bioanalytical Chemistry course (SC/BCHM 4050 3.00) can be taken as early as the third year, provided the prerequisites (SC/BCHM 2020 3.0/4.0 and SC/BCHM 2021 3.0/4.0) will have been completed in the second year and both SC/BIOL 1000 3.0 and SC/BIOL 1001 3.0 (or SC/BIOL 1010 6.0) in the first year, as these are the pre-requisites to SC/BCHM 2020 3.0/4.0. This course could be taken in the fourth year as well. It is usually available every year, but this is not guaranteed. Students may wisely plan on being able to take it in their third year (with the possibility of delaying it to the fourth year), in which case all prerequisites would need to have been taken prior to the third year.

The required Advanced Biochemistry and Molecular Genetics Laboratory (SC/BCHM 3140 4.0) course lists SC/BCHM 3110 3.0 as a pre- or corequisite, which in turn pre-requires 2000-level courses that prerequire first-year Biology. Students can take SC/BCHM 3140 as early as the Fall term of their third year. However, the SC/BCHM 3140 course description also lists SC/BCHM 3130 3.0 as a strongly recommended (but not mandatory) pre- or corequisite. Since SC/BCHM 3140 is not itself prerequisite to other courses, it can be taken as late as the Winter term of the fourth year but, because enrolment in each section is limited to 12 students, earlier registration is recommended.

The required Biotechnology course (SC/BCHM 4290 4.0) prerequires SC/BCHM 3110 3.0, which in turn pre-requires 2000-level courses that prerequire first-year Biology. The term(s) in which this course is

available in any one academic year can change. A fall offering can be taken in fourth year only if there have been no delays in taking the prerequisites.

GPA Requirements and Exit Strategies

As with any degree program, continuation and graduation in the Specialized Honours program in Biochemistry is dependent on meeting the academic standards set out by the Senate of York University and the Faculty of Science & Engineering (FSE). Entrance, continuation and graduation in the Specialized Honours program in Biochemistry require a minimum gpa of 5.5 (B) over all science (SC) courses completed and a minimum cumulative gpa of 5.0 (C+) over all courses completed.

Students whose gpa scores fall just below the minima may be able to remain in the program if awarded an *Honours Waiver* (see below). Otherwise, they will be required to withdraw from the program and then face several choices before them, including working to re-enter the program while transferring to:

the 90-credit BSc program in Biology, applying all or nearly all of their accumulated credits to that degree (minimum gpa 4.0);

the 90-credit BSc program in Chemistry, applying many of their accumulated credits to that program, but requiring additional courses in Chemistry (minimum gpa 4.0);

the 120-credit Specialized Honours BSc in Chemistry (Pharmaceutical and Biological Chemistry Stream) allows students to maximize their 1000- to 3000-level Biochemistry and Biology credits; the minimum gpa (as of Fall 2009) is nevertheless 5.5 overall (compared to 5.5 over all SC courses in the Specialized Honours Biochemistry program);

the 120-credit Honours Major degree in Chemistry, applying all of the accumulated credits, but requiring additional courses in Chemistry (minimum gpa 5.0);

the Honours degrees in Biology may be available if the minimum gpa is 6.0 over all Biology courses and 5.0 over all courses.

Students who are forced to transfer out of the Biochemistry program can work to improve their gpa score so as to regain entry into it. Re-entry is not guaranteed because of enrolment limitations (depending on what courses remain outstanding), but students keen on a degree in Biochemistry may wish to re-take earlier courses for better grades and/or to shadow the Biochemistry program from another program while improving the gpa score through better performance. Not all courses required in the Biochemistry program can be taken from outside programs due to restricted enrolments in certain courses, notably SC/BCHM 3140 4.0 and SC/BCHM 4290 4.0. Some advice on how to do better academically, whether in new courses or in repeated courses, is available on the Chemistry web site – starting at *www.chem.yorku.ca*, click on *Undergraduate Program*, then choose *Help & Advice* from the drop-down menu.

Honours Waivers

Students whose gpa scores fall just under the minima may apply for an Honours Waiver in order to remain in the program. The application is normally through an advising session and, without being automatic, the grant of a waiver will generally require that both of the following conditions be satisfied:

that the lowest grade earned makes the difference between meeting and not meeting that minimum,

that there is a realistic plan in place to improve the gpa, to include repeated or new courses.

General Education Requirement

Twelve (12) General Education credits are required for all BSc degrees. General Education requirements are normally taken 6 credits at a time in your first and second years. Some adjustment in timing of these courses may be desirable, either by enrolment in a summer session or by deferment until later years. For more details on eligible courses, see page 29. For summer course offerings, refer to the Registrar's web site at *calendars.registrar.yorku.ca/enrolmentguides*.

Summer & Evening Courses

This degree program does not require students to take courses in summer terms, but summer courses are convenient for students with not enough room in their Fall-Winter schedules or students who want a lighter Fall-Winter load. Similarly, some courses are offered evenings or have evening sections or evening laboratory sections, and these can help alleviate timetabling conflicts.

Several required courses, elective courses and many General Education courses are offered in evening sections and/or in summer terms, especially at the 1000 and 2000 levels. The choices can change from year to year, so students should always check the Lecture Schedules published on the Registrar's web site for each year's offerings (starting at *calendars.registrar.yorku.ca/enrolmentguides*, click on Course Timetables) in up-coming terms.

Most 1000-level SC courses have evening lecture and laboratory sections available every year (i.e. after the regular end of the day classes and laboratories at 5:30 pm). In Fall-Winter 2011, for instance, SC/BIOL 1000 3.0, SC/BIOL 1001 3.0, SC/CHEM 1000 3.0, SC/CHEM 1001 3.0, SC/CSE 1520 3.0 and SC/CSE 1540 3.0 are all running evening sections. Some courses, particularly large courses, have day-time lectures and tutorials but will have evening lab sections available as well (SC/BIOL 2070 3.0 and SC/CHEM 2020 6.0 are examples). Some 4000-level courses are also scheduled in the evening, often because they are co-taught with graduate courses. Students should consult the most current lecture schedules (see above) each term for their timetabling and planning needs. The Registrar publishes the Fall-Winter schedule the preceding summer.

Courses habitually offered in summer terms are marked with an 'S' in the Study Plan (p. 14) and in the Course Offerings Schedule (p. 28). Students should consult the most current lecture schedules (see above) for their timetabling and planning. The Registrar publishes the summer schedule during the Winter term (near February).

Honours Thesis – SC/BCHM 4000 8.00

All Specialized Honours students in Biochemistry must complete this 8-credit course in one or two consecutive terms, typically in the Fall and Winter terms on a part-time basis, or in the Summer term on a full-time basis (for approximately 12-16 weeks). Details on the operation of this course appear on p. 21.

Regulations Governing Academic Standards and Undergraduate Degree Requirements

Graduation

Students should apply to graduate in the calendar year in which they expect to qualify for their degree, irrespective of whether or not they plan to attend the graduation ceremony. The application to graduate form can be found at *www.yorku.ca/mygraduation/*. The deadline dates for spring and

fall graduation ensure that all potential graduates' records are assessed with care. No late applications are accepted for any reason.

A student registered in a BSc (Hons.) program may apply to graduate with a BSc degree, provided Bachelor program requirements have been met, but there is no BSc degree in Biochemistry.

Repeated Courses (as of 2009)

Students are encouraged to devote their best efforts to passing their courses, to not impede their academic progress and avoid needing to re-take a required course. In situations where success is uncertain, students are encouraged to carefully consider, before the drop deadline, the wisdom of staying enrolled in a course. In cases of failure, students cannot progress into later courses that have the failed course as a pre-requisite, except by special permission from the later courses' Course Directors.

Students are allowed to retake a failed course once for academic degree or certificate credit. If a student has compelling reasons to be allowed to withdraw from a course past the applicable drop deadline, then students are encouraged to consider filing a petition for late withdrawal, on the grounds that they had no reason to withdraw prior to the drop deadline but fell victim after the drop deadline to unavoidable circumstances that jeopardized their success.

Students attempting to enroll in a course a third time may be de-enrolled without notice. As of 2009, students may be required to obtain permission from the offering department in order to take a course a third time, and should be prepared to provide compelling reasons for that permission and convincing evidence that they will succeed the third time, having addressed the problems they faced the first two times. Permission to enroll is not a guarantee of enrollment, as enrollment may be limited. Regardless of whether or not a student gets permission to repeat a course a third time, and except in cases of Academic Dishonesty (see below), the second grade remains the grade of record and the only grade calculated in the student's grade point average (gpa), unless the student files and is granted a petition to have the third grade count in the gpa instead of the second.

The record of all attempts at a course will appear on the student's transcript, with those not counting designated as 'No Credit Retained' (NCR). Whether or not such a petition is granted and the later grade is used in the calculation of gpa scores, the successful completion of the third attempt will serve to satisfy degree requirements.

Students should note that course availability, scheduling and space considerations may preclude the possibility of repeating a course in the chosen session.

Students assigned an F or lowered grade as a penalty for Academic Dishonesty will not be allowed the benefit of excluding the impact of this 'penalty' grade from their academic average by repeating the course. Both the second grade and the original grade will contribute to the cumulative gpa.

Petitions and Grade Reappraisals

Students may petition on reasonable grounds, in writing, any Faculty of Science and Engineering or university regulation. In some instances, circumstances affecting a student's performance in initial university course work will be accepted as grounds for petition. All enquiries about regulations and petition procedures should be addressed to the Office of the Registrar but advice can be had from Science Academic Services (355 Lumbers). Petition forms are available on-line on the Registrar's

website and must be submitted to Student Client Services. Normally petitions for late withdrawal from a course will only be considered if they are submitted within three weeks of the release of final grades. Such petitions may be considered for a period of up to one year if they are based on special circumstances justifying the delay.

Grades are not matters for petition, as there is no regulation from which an exemption will change a grade. Instead, students can file (within the prescribed deadline, unless exceptional circumstances warrant) a formal request for a Grade Reappraisal, accompanied by evidence that the grade awarded was unfairly assessed on academic grounds. Normally, only final examination grades are subject to reconsideration as there is usually sufficient opportunity to challenge other term grade items but, in cases where such challenge was impeded or the outcome of such challenge was unsatisfactory owing to the same unfairness or owing to unsatisfactory interactions with the Course Director, other grade items can be included, provided that the student can produce the graded work for reconsideration. In any event, the student is expected to exercise the right to view the graded final examination paper and to challenge its marking *before* submitting a formal request for a Grade Reappraisal. The process of reappraisal involves the Chair of the department offering the course in question appointing a third party who can reasonably well assess the grading of the examination paper, and who may thereafter recommend a higher grade, a lower grade or an unchanged grade in consideration of fairness to all. In no event can this process alter the grading scheme or the method used to calculate the final letter grade.

Residence Requirement

In order to qualify for a York University BSc or BSc (Hons.) degree in a Bachelor or Honours program, a student must have successfully completed a minimum of 30 credits at York University and at least half (50%) of the requirements in each Science Major/Minor must be taken in the Faculty of Science and Engineering.

Time Limit

There is no time limit for completion of degree requirements in the Faculty of Science and Engineering. Students taking a normal full-time load of approximately 30 credits per Fall/Winter session can expect to complete a BSc degree in three Fall/Winter sessions or a BSc (Hons.) degree in four Fall/Winter sessions. A limited number of courses are also available during the Summer Session; a maximum of 15 credits can be taken in any one Summer session.

Pass/Fail Grading Option

This option is available only to students who are in good standing (i.e. not under Academic or Debarment Warning). Students must have successfully completed at least 24 credits before they may apply to take a course under this option. A maximum of 12 (passed) credits may be counted towards a BSc (Hons.) degree. Only courses not required by the major are eligible. General Education courses are ineligible.

Grading

The Faculty of Science and Engineering-approved correlation of percentage grades to letter grades that follows will be observed. This Table serves several purposes.

For the purposes of assigning letter grades in a course, the letter in the 1st column corresponding to the % range in the 4th column is used. Thus, a grade of 76% is a B+. However, Course Directors are free to set more appropriate % ranges to achieve balance, to compensate for anomalies, *etc.*

For the purposes of calculating a grade-point average (gpa) over many courses, the value in the 2nd column corresponding to the letter in the 1st column is multiplied by the number of credits. Thus, a B+ in a 6-credit course contributes 42 points. This product is summed for all courses and the sum is divided by the total credits.

For the purposes of evaluating an average letter grade, the letter from the 1st column corresponding to the range in the 3rd column in which the gpa lies is used. Thus, a B average means a gpa between 5.5 and 6.4.

letter grade	grade-point value	grade-point range	% range
A+	9	8.5+	90-100
A	8	7.5-8.4	80-89
B+	7	6.5-7.4	75-79
B	6	5.5-6.4	70-74
C+	5	4.5-5.4	65-69
C	4	3.5-4.4	60-64
D+	3	2.5-3.4	55-59
D	2	1.5-2.4	50-54
E	1	0.1-1.4	40-49
F	0	0	0-39

Other Information and Advice

Information and advice on many other subjects, for instance on Deferred Standing, Letters of Permission, changes in Major, etc. is available in the undergraduate area of the Chemistry website at *www.chem.yorku.ca/ugrad* (click on *Undergraduate Program*, then select *Help & Advice*) or from the Biology undergraduate advising website *www.yorku.ca/ugbiol/ Advising/AdvisingMain.php*.

Program Requirements

The following is an excerpt from the University Calendar description of the program. Consult the Study Plan for a more readable list of requirements arranged in a suggested sequence.

The Department of Biology and the Department of Chemistry offer jointly a Specialized Honours Program in Biochemistry with course and standing requirements as follows:

i) All BSc Honours degree candidates must complete the program core: SC/BIOL 1000 3.0 and SC/BIOL 1001 3.0 (or SC/BIOL 1010 6.0), SC/CHEM 1000 3.0, SC/CHEM 1001 3.0, SC/PHYS 1410 6.0 or SC/PHYS 1420 6.0 or SC/PHYS 1010 6.0, SC/BCHM 2020 3.0 and SC/BCHM 2021 3.0 and SC/BIOL 2040 3.0 and SC/BIOL 2070 3.0 (or SC/BCHM 2020 4.0 and SC/BCHM 2021 4.0 and SC/BIOL 2040 4.0), SC/CHEM 2011 3.0, SC/CHEM 2020 6.0, SC/CHEM 2030 4.0

ii) All BSc Honours Biochemistry degree candidates must comply with general regulation 4 (see the Faculty of Science and Engineering Regulations Governing Undergraduate Degree Requirements (section (IV) of the Calendar) by completing:

    SC/MATH 1013 3.0 and 1014.0 3.0;

    SC/CSE 1520 3.0, or SC/CSE 1530 3.0, or SC/CSE 1540 3.0

iii) 12 general education credits.

iv) All BSc Honours degree candidates must comply with general regulation 6 (see the Faculty of Science and Engineering Regulations Governing Undergraduate Degree Requirements section (IV) of the Calendar) and, in so doing, must also satisfy the course, credit and standing requirements specified below.

To declare Honours requires successful completion of at least 24 credits, a minimum cumulative credit-weighted grade point average of 5.5 (B) over all science (SC) courses completed, and a minimum cumulative credit-weighted grade point average of 4.25 over all courses completed.

To proceed in each year of the Honours program requires a minimum cumulative credit-weighted grade point average of 5.50 (B) over all science courses completed, and a minimum cumulative credit-weighted overall grade point average as specified in the Academic Standards section of the Faculty of Science and Engineering Regulations Governing Undergraduate Degree Requirements section.

To graduate in Specialized Honours Biochemistry requires successful completion of all Faculty requirements and all required program courses, a minimum cumulative credit-weighted grade point average of 5.50 (B) over all science (SC) courses completed, and a minimum cumulative credit-weighted grade point average of 5.00 (C+) over all courses completed.

Specialized Honours Biochemistry Program

the program core, as specified in i) above;
the Faculty of Science and Engineering general education and 1000-level requirements, as specified in ii) above;
SC/BCHM 3010 3.0, SC/BCHM 3051 3.0, SC/BCHM 3110 3.0, SC/BCHM 3130 3.0, SC/BCHM 3140 4.0, SC/CHEM 3020 3.0, SC/BCHM 4290 4.0, SC/BCHM 4000 8.0, SC/BCHM 4050 3.0, 9 credits from any other 3000/4000 level SC/BCHM, SC/BIOL or SC/CHEM courses,
additional elective credits, as required for an overall total of at least 120 credits.

Study Plan

This table shows a suggested study plan for a full-time student completing the degree in four years. Other combinations are possible (see below) but the need to do some courses in the proper sequence should be noted carefully (see p. 6).

Course descriptions for required and elective courses are to be found starting on page 16. Another elective course useful to hone technical writing skills is described on page 30. General Education courses are described on page 29. Courses normally also available in the summer are denoted in the right-hand column. Check the registrar's web site for course availability each summer. No courses are only available in the summer.

Year	Course	Title	Term
1	PHYS 1410 6.0,	Physics option	Y, S
	1420 6.0 or 1010 6.0		
	BIOL 1000 3.0	Biology I	
	CHEM 1000 3.0	Chem Structure	F, S
	MATH 1013 3.0	Appl Calculus I	any
	BIOL 1001 3.0	Biology II	any
	CHEM 1001 3.0	Chem Dynamics	W,S
	MATH 1014 3.0	Appl Calculus II	W,S
	CSE 1520 3.0,	Computer Science	any
	1530 3.0 or 1540 3.0	option	any
	electives‡	3 credits	any
2	CHEM 2020 6.0	Org Chem	Y, S
	BCHM 2020 3.0	Biochemistry	F, S
	BIOL 2070 3.0	Res Meth Cell Mol Biol	F,W
	CHEM 2011 3.0	Intro Thermodynamics	F
	BCHM 2021 3.0	Cell Biology	W, S
	BIOL 2040 3.0	Genetics	W, S
	CHEM 2030 3.0†	Inorg Chem	W
	electives‡	6 credits	any
3	CHEM 3020 3.0	Org Chem II	F
	BCHM 3051 3.0	Macromol Biochem	F
		Interest	
	BCHM 3110 3.0	Nucl Acid Metab	F
	BCHM 3140 4.0	Adv Biochem & Molec	F, W
		Genet Lab	
	BCHM 3010 3.0	Adv Biochemistry	W
	BCHM 3130 3.0	Regulat Gene Express	W
	electives‡	11 credits	any
4	BCHM 4000 8.0	Honours Thesis	Y, S
	BCHM 4290 4.0	Biotechnology	F, W
	BCHM 4050 3.0	Bioanalytical Chem	F, W
	electives‡	15 credits	any

Notes:

‡ Elective credits are credits in unspecified courses needed to meet Faculty and University requirements. The 120-credit program includes 35† elective credits, of which:

- at least 12 must be in General Education courses; and
- at least 9 must be in 3000- or 4000-level BCHM, BIOL or CHEM courses not already required;
- the remaining credits required to achieve 120 credits in total can be made up of courses in any subject.

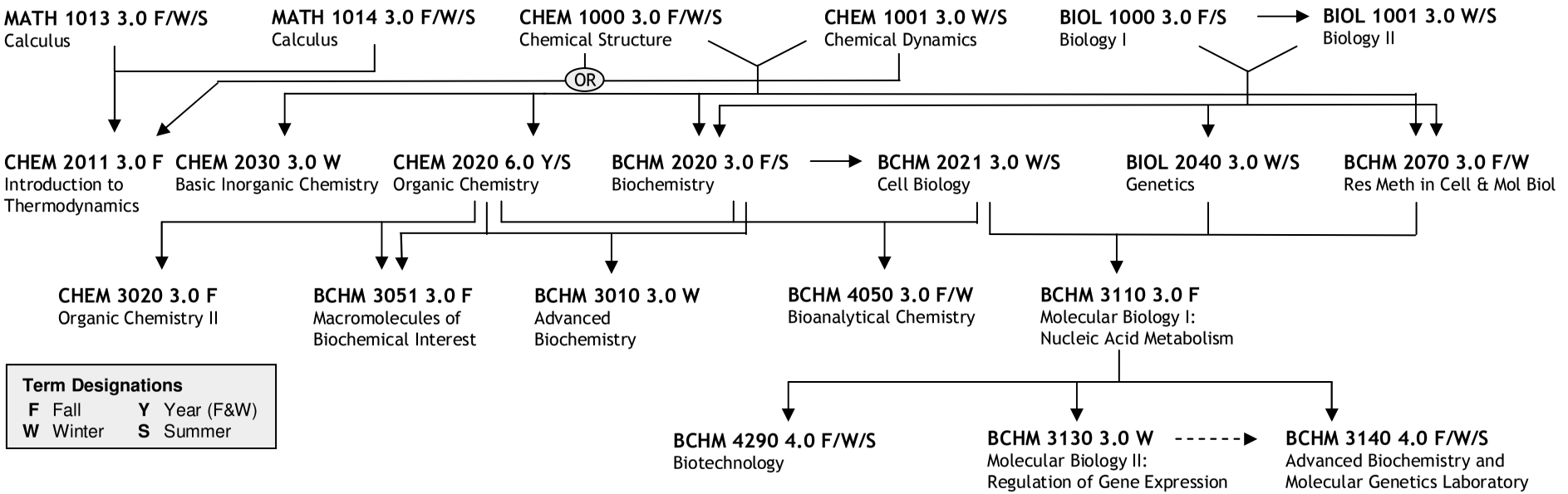
The elective credits need not be taken as suggested in this plan, which afford exactly 30 credits in each year. Other combinations are possible, but a normal course load would have about 30 credits per year.

† If SC/CHEM 3020 4.0 is taken instead of SC/CHEM 3020 3.0, you will need one less elective credit. The same is true if you have taken SC/CHEM 2030 4.0 before Fall 2006, instead of SC/CHEM 2030 3.0. Students with both SC/CHEM 2030 4.0 and SC/CHEM 3020 4.0 will need two fewer elective credits to achieve the 120-credit total.

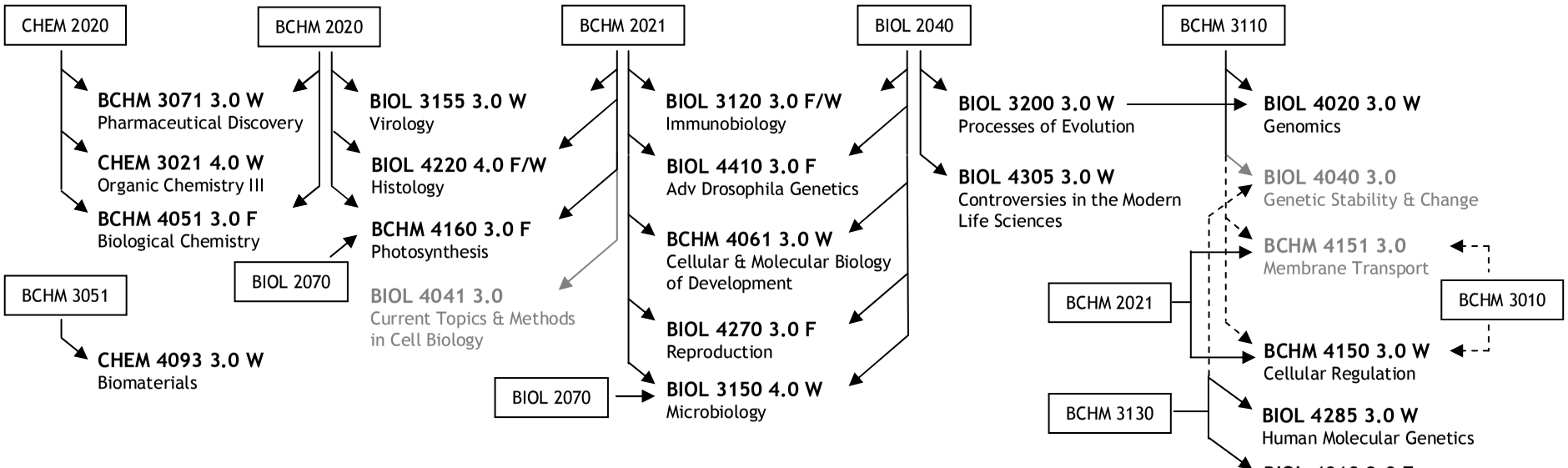
Biochemistry: Scheduling & Prerequisite Structure

For 2011-2012

Required Courses



Some Elective Courses



This chart shows which elective BCHM, BIOL and CHEM courses can be accessed with the program-required courses above. Not all possible elective courses are shown. Those not shown may have additional pre-requisites. Dashed lines indicate recommended pre- or corequisites. Not all courses are offered every year. The terms indicated apply to 2011-2012. Courses in grey are not offered in 2011-2012.

COURSE DESCRIPTIONS FOR REQUIRED COURSES

SC/BIOL 1000 3.00 BIOLOGY I: CELLS, MOLECULAR BIOLOGY AND GENETICS

An introduction to major unifying concepts and fundamental principles of biology, including evolution and cell theory. Topics include cells, biological energetics, metabolism, cell division and genetics. The laboratory and lecture components must be passed independently to pass the course. Three lecture hours per week; three laboratory hours in alternate weeks. One term. Three credits.

Prerequisite(s): OAC Biology or 12U Biology or SC/BIOL 1500 3.00; OAC Chemistry or 12U Chemistry or SC/CHEM 1500 4.0.

Course Credit Exclusion(s): SC/BIOL 1010 6.0, SC/BIOL 1410 6.0, AK/NATS 1910 6.0.

SC/BIOL 1001 3.00 BIOLOGY II: CELLS, MOLECULAR BIOLOGY AND GENETICS

A continuation of Biology I, exploring major unifying concepts and fundamental principles of biology, building on earlier concepts. Topics include mechanisms of evolution, ecology, a survey of biodiversity and conservation biology. The laboratory and lecture components must be passed independently to pass the course. Three lecture hours per week; three laboratory hours in alternate weeks. One term. Three credits.
Prerequisite(s): SC/BIOL 1000 3.00.

Course Credit Exclusion(s): SC/BIOL 1010 6.0, SC/BIOL 1410 6.0, AK/NATS 1910 6.0.

SC/CHEM 1000 3.00 CHEMICAL STRUCTURE

An introduction to chemistry, with emphasis on the physical and electronic structure of matter, including gases, liquids and solids. Topics include the behaviour of gases, thermochemistry, atomic structure and the periodic table, chemical bonding and architecture, the structure of liquids and solids, and frontiers in chemistry. Three credits.
SUMMER - Three lecture hours per week, one tutorial hour per week, 1 three-hour laboratory session on alternate weeks.
FALL - Two and one-half lecture hours per week, one tutorial hour per week, six three-hour laboratory sessions. One term.
Prerequisite(s): 12U/OAC Chemistry or SC/CHEM 1500 4.00 or equivalent.
Course Credit Exclusion(s): SC/CHEM 1000 6.00, SC/CHEM 1010 6.00, AK/CHEM 2000 6.00.

SC/CHEM 1001 3.00 CHEMICAL DYNAMICS

A complement to SC/CHEM 1000 3.00 with emphasis on chemical change and equilibrium. Topics include chemical kinetics, chemical equilibrium, entropy and free energy as driving forces for chemical change, electrochemistry and frontiers in chemistry. Three credits.
SUMMER - Three lecture hours per week, one tutorial hour per week, 1 three-hour laboratory session on alternate weeks.
WINTER - Two and one-half lecture hours per week, one tutorial hour per week, six three-hour laboratory sessions. One term.
Prerequisite(s): 12U/OAC Chemistry or SC/CHEM 1500 4.00 or equivalent.
Course Credit Exclusion(s): SC/CHEM 1000 6.00, SC/CHEM 1010 6.00, AK/CHEM 2000 6.00.

SC/CSE 1520 3.00 COMPUTER USE: FUNDAMENTALS

An introduction to the use of computers focusing on concepts of computer technology and organization (hardware and software) and the use of applications such as spreadsheets, database and information retrieval tools for problem solving. The course requires extensive laboratory work. This course is designed for students who are not computer science majors. Students who plan to major in computer science are advised to take SC/CSE 1020 3.00.
Course Credit Exclusion(s): AK/AS/SC/COSC 1520 3.00. NCR Note: This course is not open to any student who has passed or is taking AK/AS/SC/CSE 1020 3.00, AK/AS/SC/COSC 1020 3.00.

SC/CSE 1530 3.00 COMPUTER USE: PROGRAMMING

Concepts of computer systems and technology – e.g. software engineering, algorithms, programming languages, theory of computation. Practical work focuses on problem solving using a high-level programming language. The course requires extensive laboratory work. This course is designed for students who are not Computer Science majors, but may be used as preparation by those who wish to major in Computer Science but lack programming background. Students who plan to major in Computer Science must also take CSE 1020 3.00 and CSE 1030 3.00.
Course Credit Exclusion(s): AK/AS/SC/COSC 1530 3.00, AK/AS/SC/CSE 1540 3.00 or AK/AS/SC/COSC 1540 3.00, SC/CSE 1570 3.00 NCR Note: This course is not open to any student who has passed or is taking SC/CSE 1020 3.00 or AK/AS/SC/COSC 1020 3.00 or AP/ITEC 1620 3.00. Prior to Fall 2009: NCR Note: This course is not open to any student who has passed or is taking AK/AS/SC/CSE 1020 3.00 or AK/AS/SC/COSC 1020 3.00 or AK/AS/ITEC 1620 3.00.

SC/CSE 1540 3.00 COMPUTER USE FOR THE NATURAL SCIENCES

Introduction to problem solving using computers - top down and modular design; implementation in a procedural programming language - control structures, data structures, subprograms; application to simple numerical methods, modelling and simulation in the sciences; use of library subprograms.
Course Credit Exclusion(s): AK/AS/SC/COSC 1540 3.00, CSE 1530 3.00, AK/AS/SC/COSC 1530 3.00. NCR Note: This course is not open to any student who has passed or is taking SC/CSE 1020 3.00 or AP/ITEC 1620 3.00. Prior to Fall 2009: NCR Note: This course is not open to any student who has passed or is taking CSE 1020 3.00 or AK/AS/SC/COSC 1020 3.00 or AK/AS/ITEC 1620 3.00.

SC/MATH 1013 3.00 APPLIED CALCULUS I

Introduction to the theory and applications of both differential and integral calculus. Limits. Derivatives of algebraic and trigonometric functions. Riemann sums, definite integrals and the Fundamental Theorem of Calculus. Logarithms and exponentials, Extreme value problems, Related rates, Areas and Volumes.
Prerequisite(s): SC/MATH 1515 3.00 or SC/MATH 1520 3.00, or a high-school calculus course.
Course Credit Exclusion(s): SC/MATH 1000 3.00, SC/MATH 1300 3.00, SC/MATH 1505 6.00, SC/MATH 1513 6.00, SC/MATH 1530 3.00, SC/MATH 1550 6.00, GL/MATH/MODR 1930 3.00, AP/ECON 1530 3.00.

SC/MATH 1014 3.00 APPLIED CALCULUS II

Calculus in Polar Coordinates. Techniques of Integration. Indeterminate Forms. Improper Integrals. Sequences, infinite series and power series. Approximations. Introduction to ordinary differential equations.

Prerequisite(s): One of SC/MATH 1000 3.00, SC/MATH 1013 3.00, SC/MATH 1300 3.00, or SC/MATH 1513 6.00
Course credit exclusion(s): SC/MATH 1010 3.00, SC/MATH 1310 3.00, SC/MATH 1505 6.00, GL/MATH/MODR 1940 3.00.

SC/PHYS 1010 6.00 PHYSICS

Topics include linear, rotational and oscillatory motion; Newtonian mechanics; gravitation; electrostatics; magnetostatics; electric current and induction; heat; geometrical and physical optics and sound. Differential and integral calculus and vector algebra are used. This course covers fewer topics than SC/PHYS 1410 6.00, but covers them in greater depth. It should be taken by all those likely to enrol in 2000-level physics courses. Includes three hour laboratory component normally in alternating weeks.
Prerequisite(s): OAC Physics or 12U Physics or SC/PHYS 1510 4.00.
Corequisite(s): SC/MATH 1013 3.00 and SC/MATH 1014 3.00, or SC/MATH 1505 6.00, or equivalents.
Course credit exclusion(s): SC/PHYS 1410 6.00 and SC/PHYS 1420 6.00.

SC/PHYS 1410 6.00 PHYSICAL SCIENCE

A survey of physics. Topics include kinematics, dynamics, momentum and energy for linear and rotational motion; elementary kinetic theory and thermodynamics; static and current electricity; waves and physical and geometrical optics; elements of modern physics. This is a calculus-based course recommended for students unlikely to take 2000-level Physics courses. It includes a three hour laboratory component, normally in alternating weeks.
Prerequisite(s): 12U Physics or OAC Physics or SC/PHYS 1510 4.00; MHF4U Advanced Functions and MCV4U Calculus and Vectors, or 12U Advanced Functions and Introductory Calculus, or OAC Algebra and OAC Calculus, or SC/MATH 1505 6.00, or SC/MATH 1520 3.00.
Course credit exclusion(s): SC/PHYS 1010 6.00, SC/PHYS 1420 6.00.

SC/PHYS 1420 6.00 PHYSICS WITH APPLICATIONS TO LIFE SCIENCES

A survey of physics in which many fundamental concepts are emphasized through applications to the life sciences. Topics include kinematics, dynamics, momentum and energy for linear and rotational motion; elementary kinetic theory and thermodynamics; static and current electricity; waves and physical and geometrical optics; elements of modern physics. This is a calculus-based course recommended for students unlikely to take 2000-level Physics courses. It includes a three-hour laboratory component, normally in alternating weeks.
Prerequisite(s): 12U Physics or OAC Physics or SC/PHYS 1510 4.00; MHF4U Advanced Functions and MCV4U Calculus and Vectors, or 12U Advanced Functions and Introductory Calculus, or OAC Algebra and OAC Calculus, or SC/MATH 1505 6.00, or SC/MATH 1520 3.00.
Course credit exclusion(s): SC/PHYS 1010 6.00, SC/PHYS 1410 6.00.

SC/BCHM 2020 3.00 BIOCHEMISTRY

A study of the cell biology and biochemistry of biomolecules. Topics include intermediary metabolism related to bioenergetics, including the biology of mitochondria and chloroplasts, protein structure and function, nucleic acid replication, gene expression, chromosome organization and recombinant DNA technology. Three lecture hours.

Prerequisite: Both SC/BIOL 1000 3.00 and SC/BIOL 1001 3.00 or SC/BIOL 1010 6.00; both SC/CHEM 1000 3.00 and SC/CHEM 1001 3.00, or SC/CHEM 1000 6.00.

Course Credit Exclusions: SC/BIOL 2020 4.00, SC/BCHM 2020 4.00, SC/CHEM 2050 4.00.

Cross-listed to: SC/BIOL 2020 3.00.

Other Information: While an organic chemistry course is not a prerequisite there will be a substantial amount of material in this course which will require an understanding of organic chemistry. Students who are weak in this area should consider taking SC/CHEM 2020 6.00 as a co-requisite.

SC/BCHM 2021 3.00 CELL BIOLOGY

A study of cell biology and aspects of related biochemistry. Topics include membranes, the endomembrane system, the cytoskeleton, cellular motility, the extracellular matrix, intercellular communication and intracellular regulation. Three lecture hours.

Prerequisite(s): One of the following: (1) SC/BIOL 2020 4.00, (2) SC/BCHM 2020 4.00, (3) SC/BIOL 2020 3.00, (4) SC/BCHM 2020 3.00, (4) SC/BIOL 1010 6.00 and SC/CHEM 2050 4.00, (5) SC/BIOL 1000 3.00 and SC/BIOL 1001 3.00 and SC/CHEM 2050 4.00.

Course credit exclusion(s): SC/BIOL 2021 4.00, SC/BCHM 2021 4.00.

Cross-listed to: SC/BIOL 2021 3.00.

SC/BIOL 2040 3.00 GENETICS

A study of the organization and behaviour of genes and chromosomes and their roles in cells, organisms, populations and evolution. Three lecture hours, one tutorial hour.

Prerequisite(s): Both SC/BIOL 1000 3.00 and SC/BIOL 1001 3.00 or SC/BIOL 1010 6.00.

Course credit exclusion(s): SC/BIOL 2040 4.00.

SC/BIOL 2070 3.00 RESEARCH METHODS IN CELL AND MOLECULAR BIOLOGY

This course focuses on laboratory techniques in the life sciences. Practical research skills are developed through experiential learning (via integrated and relevant laboratory techniques). Research skills include scientific writing, data analysis/interpretation, experimental design and hypothesis testing. Practical experience with current techniques in cellular/molecular biology is gained in the laboratory. One lecture hour, six laboratory/practical hours per week. One term. Three credits.

Prerequisite(s): SC/BIOL 1010 6.00, or SC/BIOL 1000 3.00 and SC/BIOL 1001 3.00; SC/CHEM 1000 3.00 and SC/CHEM 1001 3.00.

SC/CHEM 2011 3.00 INTRODUCTION TO THERMODYNAMICS

This course is an introduction to equilibrium chemical thermodynamics. The three laws of thermodynamics and the thermodynamic state functions are described. Many applications are considered including the operation of heat engines, phase transformations, thermochemistry and chemical reaction equilibria. Three lecture hours, one tutorial hour.

Prerequisite(s): SC/CHEM 1000 3.00 or SC/CHEM 1001 3.00, AS/SC/MATH 1014 3.00. It is highly recommended that SC/MATH 1013 3.00 be taken as the prerequisite for AS/SC/MATH 1014 3.00.

Course Credit Exclusion(s): SC/CHEM 2050 3.00, AK/CHEM 2050 3.00

SC/CHEM 2020 6.00 ORGANIC CHEMISTRY

Structure including stereochemistry, physical and chemical properties of simple organic compounds; methods in structure determination; introductory concepts of reaction mechanisms and methods for determination of mechanisms. Six credits.

SUMMER - Five lecture hours, one tutorial hour and one three-hour laboratory session per week.
FALL/WINTER - Two and one-half lecture hours and one tutorial hour per week, three laboratory hours every second week.
Prerequisite(s): Both SC/CHEM 1000 3.00 and SC/CHEM 1001 3.00, or SC/CHEM 1000 6.00
Course Credit Exclusion(s): SC/CHEM 2020 5.00.

SC/CHEM 2030 3.00 BASIC INORGANIC CHEMISTRY

The descriptive chemistry of the more common elements is discussed within the context of qualitative inorganic analysis. Principles of ionic equilibria in aqueous solution, elementary coordination chemistry and electrochemical potentials are presented. Three lecture hours, one tutorial hour.
Prerequisite(s): Both SC/CHEM 1000 3.00 and SC/CHEM 1001 3.00, or SC/CHEM 1000 6.00.

SC/BCHM 3010 3.00 ADVANCED BIOCHEMISTRY

A detailed discussion of enzyme structure and function as well as the chemistry and metabolism of biological molecules including amino acids, nucleotides, lipids and polysaccharides. Control of metabolism at the level of enzyme activity. Knowledge of general concepts of metabolism, details of the major pathways of energy metabolism and of basic aspects of enzyme structure and function is assumed. Three lecture hours per week.
Cross-listed to: SC/BIOL 3010 3.00, SC/CHEM 3050 3.0.
Prerequisite(s): SC/CHEM 2020 6.00, SC/BCHM/BIOL 2020 3.00/4.00 or SC/CHEM 2050 4.00.

SC/BCHM 3051 3.00 MACROMOLECULES OF BIOCHEMICAL INTEREST

A discussion of the structures and functions of naturally occurring macromolecules including nucleic acids, proteins, polysaccharides and related macromolecular conjugates. Three lecture hours per week.
Cross-listed to: SC/BIOL 3051 3.00, SC/CHEM 3051 3.00.
Prerequisite(s): SC/CHEM 2020 6.00; SC/BCHM 2020 3.00/4.00 or SC/CHEM 2050 4.00.

SC/BCHM 3110 3.00 MOLECULAR BIOLOGY I: NUCLEIC ACID METABOLISM

Discussion of the metabolism of DNA and RNA, including the physical chemical properties of nucleic acids; DNA protein interactions; chromosome structure; nucleic acid replication, repair and recombination; recombinant DNA technology. Three lecture hours. One term. Three credits.
Prerequisite(s): One of: (1) SC/BCHM/BIOL 2020 4.00 and SC/BCHM/BIOL 2021 4.00 and SC/BIOL 2040 4.00; (2) SC/BCHM/BIOL 2020 3.00 and SC/BCHM/BIOL 2021 3.00 and SC/BIOL 2040 3.00 and SC/BIOL 2070 3.00.
Cross-listed to: SC/BIOL 3110 3.00.
Other Information: This course is designed to provide an understanding of molecular processes involved in nucleic acid (DNA and RNA) metabolism and will teach not only the facts, but also insights into how that information was and is being obtained. Topics will include: the structure and function of DNA and RNA, chromosome structure and function, DNA and RNA replication, DNA repair, genetic recombination, the molecular anatomy of eukaryotic genes and genomes and programmed and unprogrammed genomic rearrangements. Molecular mechanisms underlying the regulation of gene expression will be discussed in SC/BCHM 3130 3.00, Molecular Biology II.

SC/BCHM 3130 3.00 Molecular Biology II: Regulation Of Gene Expression

Gene structure and function. Mechanisms of gene expression in prokaryotes and eukaryotes. Storage and retrieval of genetic information; transcription, translation and their control. Three lecture hours. One term. Three credits.
Prerequisite(s): SC/BCHM/BIOL 3110 3.00.
Cross-listed to: SC/BIOL 3130 3.00.

SC/BCHM 3140 4.00 Advanced Biochemistry & Molecular Genetics Laboratory

Research techniques used in biochemistry and molecular biology, including recombinant DNA technology, are illustrated. Purification of a restriction endonuclease; isolation and mapping of bacterial plasmids, bacteriophage and recombinant molecules; PCR (polymerase chain reaction); nucleic acid hybridization. Enrolment restricted to 12 students. One lecture hour, six laboratory hours two days per week, plus additional laboratory hours throughout the week. One term. Four credits.
Prerequisite(s) or corequisite(s): SC/BCHM/BIOL 3110 3.00, SC/BCHM/BIOL 3130 3.00 strongly recommended as a prerequisite or corequisite.
Cross-listed to: SC/BIOL 3140 4.00.
Other Information: Enrolment is restricted in this course. Qualified students who wish to enroll in the course should visit the Biology Undergraduate Office to ask to be put on the appropriate list. Decisions will be made in early April (for summer) and early July (for Fall/Winter) in terms of enrollment permissions.

SC/CHEM 3020 3.00/4.00 Organic Chemistry II

A course organizing structural organic chemistry on a mechanistic basis and applying these mechanisms to synthesis. The application of spectroscopic methods will also be incorporated where appropriate. Three lecture hours (and one tutorial hour)* per week. One term. Three credits.
Prerequisite(s): SC/CHEM 2020 6.00.
*Pending approval.

SC/BCHM 4000 8.00 Honours Thesis

An independent research project, supervised by a faculty member specializing in Biochemistry. Evaluation is based on practical performance, an oral presentation and a written thesis. May be carried out in one term or two consecutive terms. At least 288 hours of work on the project are required. Eight credits. Only open to Honours Biochemistry students in the final year of study, or by permission of the program.

Course-credit exclusion(s): SC/BIOL 4000 8.00, SC/CHEM 4000 8.00.

Other Information: The course is intended as a capstone course for students in Specialized Honours Biochemistry, many of whom will be interested in graduate studies subsequently. This course will provide a means of whetting their appetite for research, as well as consolidating their undergraduate studies. This course be carried out in the normal academic year, or as soon as the summer after the third year. Students should note that they cannot earn remuneration and academic credit for the same work, however.
The components of the course are as follows:

1. Proposal: At the beginning of the project, a proposal giving the title, and a brief outline of the thesis topic (approximately one page in length) must be submitted jointly by the student and supervisor to the Course Director for approval. Also, an adviser will be identified at the outset. The

adviser is another faculty member who is willing to be consulted during the course of the research (for example, if the supervisor is away for a period of time) and who is willing to be an examiner.

2. Written Report on Thesis: Towards the end of the research period, the work should be written up as a small thesis (20-25 double-space typed pages is suggested) which should delineate clearly, and concentrate heavily on, the student's own contribution. Lengthy introductions, descriptions of existing methods etc. should be avoided, but there should be a brief discussion of the scientific motivation and importance of the project. The student should prepare at least four copies of the thesis, and submit three copies to the Course Director at least one week before the scheduled examination (see below). One copy of the thesis will be retained by each of the student, the supervisor and the Program.
3. Examination: The thesis will be examined by the supervisor, the adviser, and the Course Director. The examination (30-minute oral exam) will take place at a mutually convenient time during the regular examination period. The student will give an oral report on the research during a "mini-conference" day near the end of term, before the final thesis is submitted.
4. Grading: A final letter grade for each student in the course will be determined by the Course Director. The final grade will be based on the performance in the oral presentation and examination, on the quality of the thesis, on an evaluation of the student's overall performance in conducting the research project. All three evaluators –the supervisor, the adviser and the Course Director will contribute equally to the final grade.

For help in identifying a potential supervisor, see p. 31.

SC/BCHM 4050 3.00 BIOANALYTICAL CHEMISTRY

This course describes modern methods of bioanalytical chemistry in their application to the analysis of biological polymers: proteins, nucleic acids, carbohydrates and lipids. Analytical aspects of genomics and proteomics are considered. Three lecture hours.

Cross-listed to: SC/BCHM 4050 3.00, SC/BIOL 4051 3.00.

Prerequisite(s): SC/CHEM 2020 6.00, SC/BCHM/BIOL 2020 3.00/4.00 or SC/CHEM 2050 4.00, and SC/BCHM/BIOL 2021 3.00/4.00.

SC/BCHM 4290 4.00 BIOTECHNOLOGY

This laboratory course covers some of the methods currently in use in biotechnology research in industry and academia. Emphasis is placed on methods for transforming eukaryotes with marker genes. Advanced methods used in molecular biology are also covered. Two lecture hours, six laboratory hours. One Term. Four credits.

Prerequisite(s): SC/BCHM/BIOL 3110 3.00.
Cross-listed to: SC/BIOL 4290 4.00.
Course Credit Exclusion(s): SC/BIOL 4290 3.00.

DESCRIPTIONS FOR SOME ELECTIVE COURSES

More detailed information on these courses can be found from the Biology (*www.biol.yorku.ca*) and Chemistry (*www.chem.yorku.ca*) websites. Not all possible electives are listed – only those not requiring additional courses as prerequisites are listed. Other courses from these departments will have prerequisites not mandated by the program.

SC/BCHM 3071 3.00 PHARMACEUTICAL DISCOVERY

A practical look into the pharmaceutical industry, providing an overview of the drug discovery process. Topics include choosing disease states to study, pharmacological assays, rational drug design, synthetic and analytical chemistry, toxicology, drug metabolism and clinical trials. Three hours. One term. Three credits. Prerequisites: SC/BCHM/BIOL 2020 3.00/4.00 or SC/CHEM 2050 4.00; SC/CHEM 2020 6.00. Cross-listed to SC/CHEM 3071 3.00.

SC/BCHM 4051 3.00 BIOLOGICAL CHEMISTRY

Bio-organic and bio-inorganic topics: active sites in enzymes and metalloproteins, coenzymes; abiotic models; aromatic natural products, terpenoids and some alkaloid classes. Three lecture hours. One term. Three credits. Prerequisites: SC/CHEM 2020 6.00; SC/CHEM 2030 3.00/4.00 is strongly recommended. Cross-listed to SC/CHEM 4051 3.00.

SC/BCHM 4061 3.00 CELL AND MOLECULAR BIOLOGY OF DEVELOPMENT

This course presents a genetic and molecular biological approach to the field of developmental biology. Topics range from unicellular systems, both prokaryotic and eukaryotic, to more complex, multicellular systems. Three lecture hours. One term. Three credits. Integrated with: GS/BIOL 5052 3.00. Prerequisites: SC/BIOL/BCHM 2020 3.00/4.00; SC/BIOL/BCHM 2021 3.00/4.00; SC/BIOL 2040 3.00/4.00. Cross-listed to SC/BIOL 4061 3.00.

SC/BCHM 4150 3.00 CELLULAR REGULATION

A detailed examination of molecular, cellular and physiological processes associated with the action of peptide hormones, neuro-transmitters and growth factors. Emphasis is on cell receptors and signal transduction mechanisms involving cyclic nucleotides and calcium. Three lecture hours. One term. Three credits. Prerequisites: SC/BCHM/BIOL 2020 4.00; SC/BCHM/BIOL 2021 4.00; SC/BIOL 3010 3.00 and SC/BIOL 3110 3.00 strongly recommended as prerequisites or corequisites. Cross-listed to SC/BIOL 4150 3.00.

SC/BCHM 4151 3.00 MEMBRANE TRANSPORT

The fundamental properties of solute transport are presented by discussing active ion pumps, passive transporters and ion channels of bacteria, plants and animals. The role of transport in regulating the intracellular environment in animals and plants is emphasized. Three lecture hours. One term. Three credits. Integrated with: GS/BIOL 5051 3.00. Prerequisites: SC/BCHM/BIOL 2020 3.00/4.00; SC/BCHM/BIOL 2021 3.00/4.00; SC/BIOL 3010 3.00 and SC/BIOL 3110 3.00 strongly recommended as prerequisites or corequisites. Cross-listed to SC/BIOL 4151 3.00.

SC/BCHM 4160 3.00 PHOTOSYNTHESIS

A study of the process of photosynthesis at the biochemical, organelle and whole-organism levels, including structure of the photosynthetic apparatus, primary light-harvesting processes, electron transport, photophosphorylation, mechanism of carbon dioxide fixation in higher plants and algae, photorespiration. Two lecture hours, three laboratory hours. One term. Three credits. Prerequisite: SC/BCHM/BIOL 2021 3.00/4.00. Cross-listed to SC/BIOL 4160 3.00.

SC/CHEM 3011 3.00/4.00 PHYSICAL CHEMISTRY

This is an introductory course in chemical kinetics as applied primarily to reactions in the gas phase but also in solution and at electrode surfaces. Three lecture hours per week. One Term. Three credits (CHEM

3011 3.00). Three lecture hours per week, five three-hour laboratories. One Term. Four credits (CHEM 3011 4.00). Prerequisites: SC/CHEM 2011 3.00. Course Credit Exclusion(s): SC/CHEM 3210 4.00.

SC/CHEM 3021 3.00/4.00 ORGANIC CHEMISTRY III

A course building on SC/CHEM 3020 4.00 and introducing methods for probing mechanisms, base-catalyzed reactions, rearrangements, cyclization, strain, pericylic reactions and other topics. Three lecture hours per week. One term. Three credits. Three lecture hours per week, eight three-hour laboratories. One term. Four credits. Prerequisite: SC/CHEM 3020 3.00/4.00.

SC/CHEM 3060 3.00 INTRODUCTORY ATMOSPHERIC CHEMISTRY

An introductory course linking chemistry and atmospheric science. Topics include atmospheric evolution; biogeochemical cycles; sources, transformations and sinks of atmospheric species; human impacts such as acid rain, photochemical smog, and depletion of the ozone layer. (Same as SC/EATS 3130 3.00.) Three lecture hours per week. One term. Three credits. Prerequisites: SC/CHEM 1001 3.00; one of AS/SC/MATH 1010 3.00, AS/SC/MATH 1014 3.00, AK/AS/SC/MATH 1310 3.00, AS/SC/MATH 1505 6.00. Course Credit Exclusion(s): SC/CHEM 3160 3.0, SC/EATS 3130 3.00.

SC/CHEM 3070 3.00 INDUSTRIAL AND GREEN CHEMISTRY

An in-depth look at various topics on the evolution of chemistry in the petrochemical, pharmaceutical, dye, agrochemical, food, personal care, cosmetic and detergent industries, including recent environmentally friendly approaches (green chemistry). Three lecture hours per week. One term. Three credits. Prerequisites: SC/CHEM 2020 6.00.

SC/CHEM 3090 3.00 INTRODUCTION TO POLYMER CHEMISTRY

This course deals with fundamental aspects of polymer science with special focus on polymer synthesis, polymerization mechanism, kinetics and the key factors which govern molecular weight, polymer architecture and properties. Applications of polymeric materials, including electronic polymers and functionalized polymers, will also be discussed. Three lecture hours per week. One term. Three credits. Prerequisites: SC/CHEM 2020 6.00. Course Credit Exclusion(s): SC/CHEM 3200A 3.0.

SC/CHEM 4024 3.00 STRUCTURE ELUCIDATION OF ORGANIC AND ORGANOMETALLIC COMPOUNDS

Spectroscopic methods for the identification of organic reaction products and other organic and organometallic unknowns, primarily for chemistry students. The main focus is on solving molecular structure using NMR techniques. Three lecture hours per week. One term. Three credits. Prerequisites: SC/CHEM 3020 3.00/4.00.

SC/CHEM 4093 3.00 BIOMATERIALS CHEMISTRY

This course serves as an introduction to materials used for biomedical applications for students with background in chemistry, physics and biology. Emphasis is on biological and biomimetic surfaces, interactions at the biomaterial/tissue interfaces, and mechanisms involved with biologically driven materials self-assembly. Three lecture hours. One term. Three credits. Prerequisites: SC/BCHM/CHEM 3051 3.00 or SC/CHEM 3090 3.00.

SC/BIOL 3120 3.00 IMMUNOBIOLOGY

The biology and chemistry of the immune response. Structure and function of antibodies; antibody diversity; anatomy and development of the immune system; cellular interactions; immunological responses in disease. Production and use of monoclonal and polyclonal antibodies. Three lecture hours. One term. Three credits. Prerequisites: SC/BCHM/BIOL 2020 3.00/4.00; SC/BCHM/BIOL 2021 3.00/4.00; SC/BIOL 2040 3.00/4.00.

SC/BIOL 3150 4.00 MICROBIOLOGY

Fundamentals of microbiology; microbial organisms; microbe-host interactions; microbial genetics and evolution; microorganisms and human disease; environmental and applied microbiology. Three lecture

hours, three laboratory hours. One term. Four credits. Prerequisites: SC/BCHM/BIOL 2020 3.00/4.00; SC/BCHM/BIOL 2021 3.00/4.00; SC/BIOL 2040 3.00/4.00. Course credit exclusion: SC/BIOL 3150 3.00.

SC/BIOL 3155 3.00 VIROLOGY

An in-depth examination of cellular, molecular and structural aspects of virology. Molecular processes and concepts are emphasized using examples from current research literature. Virus-host interactions are investigated in various systems. Three lecture hours per week. One term. Three credits. Prerequisites: SC/BCHM/BIOL 2020 3.00/4.00; SC/BCHM/BIOL 2021 3.00/4.00.

SC/BIOL 3200 3.00 PROCESSES OF EVOLUTION

The process and principles of evolution, the mechanisms by which genetic change occurs, the patterns of genetic variation and molecular studies that relate the structure of organisms to their evolution are examined. Three lecture hours. One term. Three credits. Prerequisite: SC/BIOL 2040 3.00/4.00.

SC/BIOL 4010 3.00 BIOLOGY OF CANCER

This course will explore the basic molecular and cellular concepts and principles related to the development of cancer, and medical applications to treatment and prevention of the disease. Three lecture hours. One term. Three credits. Prerequisites: SC/BIOL 3130 3.00 or SC/BCHM 3130 3.00.

SC/BIOL 4020 3.00 GENOMICS

The study of genome structure, function and evolution, with emphasis on the primary literature. Topics include: gene duplication, evolution of noncoding DNA, population genomics, horizontal gene transfer, transposable element evolution and base composition. Three lecture hours. One term. Three credits. Prerequisites: SC/BCHM/BIOL 3110 3.00; SC/BIOL 3200 3.00

SC/BIOL 4040 3.00 GENETIC STABILITY AND CHANGE

Stability and flexibility of the genomes of prokaryotic and eukaryotic cells. Genetic recombination, DNA repair, mutation inductions; genome rearrangement and the transposition of DNA. The roles of these processes in evolution and in the induction of human disease. Three lecture hours. One term. Three credits. Prerequisite: SC/BCHM/BIOL 3110 3.00; SC/BCHM/BIOL 3130 3.00 strongly recommended as pre- or corequisite.

SC/BIOL 4041 3.00 CURRENT TOPICS AND METHODS IN CELL BIOLOGY

Selected topics in cell biology, such as membrane dynamics, cell cycle control, apoptosis, signal transduction and cellular rhythmicity. Presentation and critical discussion of recent research papers, emphasizing current methods and experimental design. Three lecture hours. One term. Three credits. Prerequisites: SC/BCHM/BIOL 2020 3.00/4.00; SC/BCHM/BIOL 2021 3.00/4.00; or equivalent. Integrated with: GS/BIOL 5064 3.00. Course credit exclusion: SC/BIOL 4140 3.00 from Fall/Winter 2002-2003 only.

SC/BIOL 4150 3.00 CELLULAR REGULATION

A detailed examination of molecular, cellular and physiological processes associated with the action of peptide hormones, neuro-transmitters and growth factors. Emphasis is on cell receptors and signal transduction mechanisms involving cyclic nucleotides and calcium. Three lecture hours. One term. Three credits. Prerequisites: SC/BCHM/BIOL 2020 3.00/4.00; SC/BCHM/BIOL 2021 3.00/4.00; SC/BCHM/BIOL 3010 3.00 (or SC/CHEM 3050 3.00) and SC/BCHM/BIOL 3110 3.00 strongly recommended as prerequisites or corequisites.

SC/BIOL 4220 4.00 HISTOLOGY

Structure and function of tissues in vertebrates, with special emphasis on human histology. The laboratory deals with basic histological and histochemical techniques, such as tissue sectioning and staining, and localization of enzymes. Three lecture hours, three laboratory hours. One term. Four credits. Prerequisites: SC/BCHM/BIOL 2020 3.00/4.00; SC/BCHM/BIOL 2021 3.00/4.00.

SC/BIOL 4270 3.00 REPRODUCTION

Molecular, genetic, cytological and evolutionary aspects of sexual reproduction. Comparison of the regulatory genes and proteins of sexual differentiation in Saccharomyces, Drosophila, Caenorhabditis elegans, mice, human and plants. Evolutionary advantages and disadvantages of sexual reproduction; asexual reproduction through parthenogenic mechanisms. Three lecture hours. One term. Three credits. Integrated with: GS/BIOL 5035 3.00. Prerequisites: SC/BCHM/BIOL 2020 3.00/4.00; SC/BCHM/BIOL 2021 3.00/4.00; SC/BIOL 2040 3.00/4.00.

SC/BIOL 4285 3.00 HUMAN MOLECULAR GENETICS

The course covers the application of genetic and molecular biological techniques to study human diseases and other related areas, and discusses ethical concerns that might arise from this research. Three lecture hours. One term. Three credits. Prerequisite or corequisite: SC/BCHM/BIOL 3130 3.00.

SC/BIOL 4305 3.00 CONTROVERSIES IN THE MODERN LIFE SCIENCES

The study of past and contemporary controversies in genetics, evolutionary theory and ecology. The focus is on analyzing the diverse aims, concepts, theories, techniques and institutional strategies which have shaped the development of modern biology. Three lecture hours. One term. Three credits. Prerequisite: SC/BIOL 2040 3.00/4.00.

SC/BIOL 4410 3.00 ADVANCED DROSOPHILA GENETICS

A study of recent advances in Drosophila genetics. The course addresses techniques such as chromosomal analysis, lethal tagging, genetic dissection, mosaic analysis, genetic screens, transposon tagging, enhancer trapping, methods for manipulating genes in transgenic flies and genetic ablation. Three lecture hours. One term. Three credits. Prerequisites: SC/BCHM/BIOL 2020 3.00/4.00; SC/BCHM/BIOL 2021 3.00/4.00; SC/BIOL 2040 3.00/4.00.

SC/BIOL 4510 3.00 CELLULAR AND MOLECULAR BASIS OF MUSCLE PHYSIOLOGY

Topics include muscle development, muscle-specific gene expression, molecular basis of muscle contraction, biochemical plasticity of muscle, sarcolemmal and nuclear signal transduction in muscle. Three lecture hours per week. One term. Prerequisite(s): AS/SC/KINE 3011 3.00, or both SC/BCHM/BIOL 2020 3.00/4.00 and SC/BCHM/BIOL 2021 3.00/4.00.

SC/BIOL x60x 0.00 RESEARCH PRACTICA

SC/BIOL 1601 0.00, SC/BIOL 1602 0.00, SC/BIOL 2601 0.00, SC/BIOL 2602 0.00, SC/BIOL 3601 0.00, SC/BIOL 3602 0.00, SC/BIOL 4601 0.00, SC/BIOL 4602 0.00

These courses offers the student research experience as part of a Biology or Biochemistry research team in a structured framework. The student must make arrangements with a faculty member before enrolling in this course.

Prerequisites: None.

Note: These courses do not count for degree credit in any program. Students are expected to commit to approximately 5-10 hours per week (on average) for one term. The student and faculty member must sign a form in which they agree on the type and amount of work to be done, and the form must be approved by the Course Director before the student will be allowed to enroll. Students may enroll in this course during any term, and there is no limit to the number of terms in which they are allowed to enroll. Students will not be allowed to enroll in a research practicum course with their Honours Thesis (BIOL 4000 or BCHM 4000) supervisor during the same terms that they are enrolled in BIOL 4000 8.00 or BCHM 4000 8.00. The course evaluation will be pass/fail only. Students will be required to obtain safety training, such as WHMIS, if appropriate to the type of research undertaken. The course is intended only for students in Biology or Biochemistry majors.

SC/CHEM x20x 0.00 Research Experience Term Courses

SC/CHEM 2200 0.00, SC/CHEM 2201 0.00, SC/CHEM 2202 0.00, SC/CHEM 3200 0.00, SC/CHEM 3201 0.00, SC/CHEM 3202 0.00, SC/CHEM 4200 0.00, SC/CHEM 4201 0.00, SC/CHEM 4202 0.00

A sequence of non-credit, pass/fail courses providing part-time supervised research and supplementary laboratory experience. Open only to Chemistry and Biochemistry majors, by permission and subject to availability. Pre-requisites apply. Minimum time commitment: 5 hours per week. One term each, and each available in Fall, Winter and Summer terms.

These non-credit courses provide the structure by which Chemistry and Biochemistry majors can seek and obtain enrichment in terms of professionalism, research experience and practical, specialized laboratory training supplementing that provided by credit courses, to be conducted on a part-time basis under the supervision of one or more participating faculty members. Regular on-campus attendance, face-to-face communication with the supervisor(s) and/or laboratory personnel and active participation in group meetings may be expected.

There are three instantiations of the courses at the 2000, 3000 and 4000 levels, allowing students to enrol in up to three terms at each level. The prerequisites are sequential and the pass/fail grading will prevent students having failed one instance from continuing at that year level. The course and (pass/fail) grade will appear on the student's transcript.

Potential supervisors are identified by the student or by the Course Director. A written Student-Supervisor Agreement listing the student's course load and other obligations, outlining the tasks and other expectations, and detailing the hours involved will be filed with the Course Director before permission to enrol is given. At the end of the term, the supervisor(s) will provide the student and the Course Director with a pass/fail grade and an assessment of the degree to which the student will have met the agreed-upon expectations and the learning objectives.

For more detailed information and procedures to follow, see *www.chem.yorku.ca/ugrad/home.htm?VOLUNTEER*

Fall/Winter 2011–2012 Sessional Dates

Disclaimer: These dates are subject to change. Kindly refer to the Registrar's website for up-to-date sessional dates.

	Term F	Term W	Term Y
Fall Classes Start	Sep 7		Sep 7
Fall Reading Week	Oct 8 – 14		
Fall Classes End	Dec 6		Dec 6
Fall Exams Start*	Dec 8		Dec 8
Fall Exams End*	Dec 22		Dec 22
Winter Classes Start		Jan 3	Jan 3
Winter Reading Week		Feb 18 – 24	
Winter Classes End		Apr 2	Apr 2
Winter Exams Start*		Apr 4	Apr 4
Winter Exams End*		Apr 20	Apr 20
Last date to enrol without permission of course instructor	Sep 20	Jan 16	Sep 20
Last date to enrol with permission of course instructor	Oct 4	Jan 30	Oct 25
Last date to drop courses without receiving a grade	Nov 11	Mar 9	Feb 10

* Be sure to make no travel plans for the entire examination period. You are required to be available during the entire period in case a last-minute rescheduling becomes necessary.

Course Offerings 2011-2012 – Required and Elective Courses

	terms			terms			terms	
BCHM 2020	**F, S**		**CHEM 1000**	**F, W, S**	☾	**BIOL 1000**	**Y, S**	☾
BCHM 2021	**W, S**		**CHEM 1001**	**W, S**	☾	**BIOL 1001**	**W, S**	☾
BCHM 3010	**W**		**CHEM 1500**	**F**		**BIOL 2040**	**W, S**	
BCHM 3051	**F**		**CHEM 2011**	**F**		**BIOL 3120**	**W**	
BCHM 3071	**W**		**CHEM 2020**	**Y, S**		**BIOL 3150**	**W**	
BCHM 3110	**F, W**	☾	**CHEM 2030**	**W**		**BIOL 3155**	**W**	
BCHM 3130	**W**		**CHEM 3011**	**F**		**BIOL 3200**	**F**	
BCHM 3140	**F, W, S**		**CHEM 3020**	**F**		**BIOL 4010**	**F**	
BCHM 4000	**Y, W/S, S, S/F**		**CHEM 3021**	**W**		**BIOL 4020**	**F**	
BCHM 4050	**F, W**		**CHEM 3060**	**W**		**BIOL 4040**		
BCHM 4051	**F**		**CHEM 3070**	**F**		**BIOL 4041**		
BCHM 4061	**W**		**CHEM 3090**	**W**		**BIOL 4220**	**F, W**	
BCHM 4150	**W**		**CHEM 4024**	**W**		**BIOL 4270**	**F**	
BCHM 4151			**CHEM 4093**	**W**		**BIOL 4285**	**W**	
BCHM 4160	**F**					**BIOL 4305**	**W**	
BCHM 4290	**F, W, S**					**BIOL 4410**	**F**	
						BIOL 4510		

☾ indicates courses scheduled or with sections available in the evening; some day courses have evening lab sections available.

S = summer, F = fall, W = winter, Y = year (fall & winter)

A blank entry indicates that the course is not offered in 2011-12.

This schedule is subject to change. See the Registrar's website for up-to-date lecture scheduling.

GENERAL EDUCATION COURSES

For Honours Bachelor of Science And Bachelor of Science Degrees

For all Information: *science.yorku.ca/gened-bsc.html*

General Education courses are required within all BSc and BSc (Hons.) degree programs. These non-science courses are also expected to enhance students' critical skills in reading, writing, and thinking and contribute to their preparation for post-university life.

All BSc and BSc (Hons.) candidates must complete a minimum of 12 credits from two different areas of study, including at least 3 credits from each area, subject to the restrictions noted below. For the purposes of this regulation "different area" means offered by different academic units such as divisions, departments or Faculties and excluding courses offered by similar departments in different Faculties (such as English in the Faculty of Arts and Atkinson College).

Subject to the restrictions listed below, courses:

In the following areas may be taken in the Faculty of Liberal Arts and Professional Studies or Glendon College:

Anthropology, Classical Studies*, Economics, English, French Studies*, Geography**, History, Humanities, Languages, Literature & Linguistics*, Philosophy, Politcal Science, Social Science, Sociology, Women's Studies***

in the Faculty of Environmental Studies:

ES/ENVS 1000 6.00.

in the Faculty of Fine Arts:

FA/DANC 1340 3.0, 2340 3.0; FA/FILM 1400 6.0, 2401 6.0; FA/INFA 1900 6.0, 1940 6.0, 2900 6.0; FA/MUSI 1511 3.0, 1512 3.0, 1520 6.0, 1530 6.0; FA/THEA 1500 6.0, 2210 3.0; FA/VISA 1110 6.0, 1340 6.0, 2110 6.0, 2540 6.0, 2550 6.0, 2560 6.0, 2620 6.0, 2680 3.0.

in Atkinson College:

AK/FA 2100 6.0; AK/MUSI 2210 6.0; AK/VISA 2410 6.0, 3400 6.0, 3420 6.0, 3430 6.0.

General education courses are normally taken at the 1000 or 2000 level, but higher-level courses are acceptable, subject only to prerequisites and course access specifications for enrolment.

Permission may be granted by the Office of Science Academic Services, on an individual basis, for a student to take a course outside the areas and Faculties listed above for general education credit, subject to the course fulfilling the Faculty of Science & Engineering (FSE) breadth and critical skills requirements for general education courses, the student having the appropriate prerequisites and the course access specifications permitting enrolment.

A student who is in doubt regarding whether or not any specific course will fulfill the FSE general education requirements should consult the Office of Science Academic Services. The FSE maintains an updated list on its website (*science.yorku.ca/images/sribeiroyorkuca/geneds2009-1.pdf*).

Restrictions

Courses which are cross-listed as SC courses or which are eligible for SC credit cannot count as general education courses.

Courses whose major focus is increased facility in the use of a language cannot count as general education courses. Such courses are offered in the departments marked with an asterisk (*) above.

Quantitative courses focussing on techniques of mathematics or statistics cannot count as general education courses. For example, this applies to some Economics courses.

**Geography courses cannot be used to satisfy general education requirements for BSc (Hons.) or BSc candidates majoring in Geography.

***Excluding Women's Studies courses which are cross-listed with Natural Science courses.

Note: General Education courses may not be taken on a pass/fail basis (see "Pass/Fail Grading Option" in Science section in the Undergraduate Calendar).

BETHUNE WRITING CENTRE

The Bethune Writing Centre offers instruction in academic writing to students affiliated with Norman Bethune College. If you are enrolled in a Bethune course, in Science and Engineering, in Environmental Studies, or in the Science and Society Program, you may request an appointment with a Bethune writing instructor.

Bethune Writing Centre instructors are faculty members who specialize in rhetoric and composition. They have interdisciplinary backgrounds in science, environmental studies, media, literature, social science, planning, case writing, and government.

Typical assignments include lab reports, short essays, research papers, Honours Theses, Plans of Study, technical reports, and feasibility reports.

Writing instructors work on actual assignments, to help you identify audience and purpose understand the assignment discover and organize ideas present evidence in your discipline document sources in your discipline revise.

You may see a writing instructor at any stage of your writing process - from writer's block to final revisions. Be sure to bring your notes and a copy of the assignment with you to your meeting. Writing instructors do not proofread or correct grammar, but they will show you patterns of error for your attention.

Group instruction (2-4 students) is recommended and available during regular appointment times. We encourage you to set up a writing group: students with writing partners are known to achieve better results in academic writing. For more than 4 students, please ask your course instructor to request a workshop.

To book an appointment, please speak to:

Academic Secretary, 205 Bethune College, (416)736-2100 ext. 22035

Web address: *www.yorku.ca/bethune*

SC/BC 3030 3.00 TECHNICAL AND PROFESSIONAL WRITING

This writing-intensive course is for upper-year Science students and others in related fields. Students develop confidence and competence in professional and technical writing. The focus is on communication of complex information in a clear, sensible style. Three hours per week. One term. Three credits.

Prerequisite: At least 6 non-science general education credits.

Co-requisite: Concurrent enrolment in at least one 3000- or 4000-level Science course (or course which is cross-listed with a Science course), or permission of the instructor.

Course Credit Exclusions: SC/BC 3050 3.00, AS/SC/CSE 3530 3.00

Please consult the Lecture Schedule for the catalogue number to enrol via the York Enrolment System.

This course may be taken using the Pass/Fail grading option. Science students who wish to take it on a Pass/Fail basis must have completed at least 24 credits and have taken no more than 9 previous Pass/Fail credits for an Honours Bachelor of Science Degree, or no more than 3 previous Pass/Fail credits for a Bachelor of Science Degree.

AWARDS AND PRIZES IN BIOCHEMISTRY

- In 2007-08 the Departments of Chemistry & Biology established an award in the form of a book prize of $100.00 to be made to the student(s) with the highest-grade average in the core courses at the second level in biochemistry.
- The Society of Chemical Industry Merit Award is given to a student in biochemistry with the highest final-year rating. This award takes the form of a small engraved plaque for the awardee and a name plate for display.

RESEARCH OPPORTUNITIES

NSERC Undergraduate Summer Research Awards (USRA)

The Natural Sciences and Engineering Research Council (NSERC) funds a number of positions for undergraduate students in an NSERC-funded research laboratory, mostly during summer terms, in any field, in any department, and even at another university. In 2009, these scholarships were worth at least $5125 for a 16-week period of full-time work. The primary selection criterion is academic excellence, but students in their final year of study are not eligible. Aboriginal students are especially encouraged to apply. The Faculty of Science & Engineering posts information and deadlines at *www.science.yorku.ca/currentstudent/NSERCUndergraduate*, but all information and the application form are available at *www.nserc.ca*.

NSERC Industrial Undergraduate Summer Research Awards (I-USRA)

Students can instead work in a recognized industrial laboratory. The terms and amounts are similar to those above, but the application procedure and deadlines differ. Full information is found on-line at www.nserc.ca.

York Work-Study (Summer and Fall-Winter)

York University's Office of Student Financial Services assists researchers and departments in funding positions in the summer (full-time or part-time) or in the fall and winter terms (part-time) for students who need financial assistance for their studies. Positions are created in March/April for summer terms or in August/September for Fall-Winter positions, and are either posted at www.workopolis.ca or arranged through the hiring professor. Full details on procedure and eligibility are available on-line at *www.yorku.ca/osfs/wrkstdy.shtml*.

Off-Campus & International Opportunities

There are many off-campus positions available as well -- too many to list here -- including international visits and exchanges. Visit *www.science.yorku.ca* for a list of those of interest to science students.

Volunteering

Some students volunteer their time to researchers, full-time or part-time during summer, fall or winter terms, in order to get experience in a research lab or simply out of love for science. There are some limitations on how volunteers can be accommodated.

Research Practica & Research Experience Courses

Similar to volunteering, but in a structured setting. See pages 26 and 27.

How to Find a Supervisor

The most common way to identify the kind of research that would interest you, be it for paid work, for volunteering or for Honours Thesis projects, is to scan professors' websites. A list of Biochemistry professors is available at *www.biochem.yorku.ca*, including contact information and research website addresses. Summary

data are available on departmental pages (*www.biol.yorku.ca/grad/faculty.htm* and *www.chem.yorku.ca/profs*), and these provide links to more detailed descriptions and/or to individual research websites for professors whose research draws your attention. Websites are not always up to date and the content may be at a level beyond your understanding, but they can give you a good idea of the kind of research involved so that you can determine which professors to approach. However, not all professors can accommodate students in their labs, owing to their temporary unavailability during leaves or vacation, or because of a lack of time, lab space or research funding. You must therefore always communicate with them directly to determine availability.

STUDENT ORGANIZATIONS

Student organizations and clubs help make education more than just attending lectures and labs. Trips, seminars, workshops, newsletters and social events are just some of the kinds of activities that they organize. Some have collections of old tests and exams, academic help sessions or lists of tutors. Membership is usually open to students of all stripes and usually for a small fee, in return for access to activities and services.

BAY – Biochemistry Association at York
205 Bethune
e-mail: *bchm@yorku.ca*
website: *www.yorku.ca/bchm*

CSY – Chemical Society at York
317 CB
e-mail: *csy@yorku.ca*
website: *www.yorku.ca/csy*

YUBS – York University Biological Society
111 Lumbers/247 FS
e-mail: *biolsociety.yorku@gmail.com*
website: *www.yorku.ca/yubs*

YPMS – York Pre-Med Society
113 Bethune
e-mail: *ypms@yorku.ca*
website: *www.yorku.ca/ypms*

All student-run organizations and student special interest clubs are listed at *www.yorku.ca/scld/organizations/clubs.php*