



8888 University Drive, Burnaby, BC
Canada V5A 1S6

TEL: 778.782.3925
FAX: 778.782.5876

vpacad@sfu.ca
www.sfu.ca/vpacademic

MEMORANDUM

ATTENTION	Senate	DATE	October 16, 2013
FROM	Jon Driver, Vice-President, Academic and Provost, and Chair, SCUP	PAGES	1/1
RE:	Faculty of Science: Full Program Proposal for a Certificate in Genomics in the Department of Molecular Biology and Biochemistry (SCUP 13-45)		

At its September 25, 2013 meeting, SCUP reviewed and approved the Full Program Proposal for a Certificate in Genomics in the Department of Molecular Biology and Biochemistry within the Faculty of Science, effective Summer 2014.

Motion:

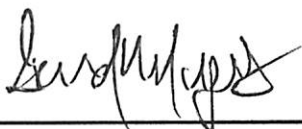
That Senate approve and recommend to the Board of Governors the Full Program Proposal for a Certificate in Genomics in the Department of Molecular Biology and Biochemistry within the Faculty of Science, effective Summer 2014.

c: B. Brandhorst

A handwritten signature in dark ink, appearing to be "Jon Driver", is written over the "c:" line.

8888 University Drive, TEL: 778.782.4636 avpcio@sfu.ca
Burnaby, BC FAX: 778.782.5876 www.sfu.ca/vpacademic
Canada V5A 1S6

MEMORANDUM

ATTENTION	Senate Committee on University Priorities	DATE	September 13, 2013
FROM	Gordon Myers, Chair Senate Committee on Undergraduate Studies	PAGES	1/1
RE:	Faculty of Science (SCUS 13-41d)		

Action undertaken by the Senate Committee on Undergraduate Studies at its meeting of September 12, 2013, gives rise to the following recommendation:

Motion

That SCUP approve and recommend to Senate the Full Program Proposal for the Certificate in Genomics in the Department of Molecular Biology and Biochemistry within the Faculty of Science.

The relevant documentation for review by SCUP is attached.

MEMO

Department of
Molecular Biology &
Biochemistry

8888 University Drive
Burnaby BC V5A 1S6

T: 778.782.5630
F: 778-782-5583

www.sfu.ca/mbb

ATTENTION **George Agnes**

TEL

FROM **Ingrid Northwood; Chair, MBB undergraduate
curriculum committee**

RE **Full Program Proposal for Certificate in Genomics**

DATE **August 28, 2013**

Motion: Full program proposal for a certificate in Genomics

Genomics is a newly emerged discipline that is already having a profound influence on other life science disciplines, as well as clinical practice and biotechnology. It involves the generation and analysis of large quantities of DNA and protein sequence data, as well as data concerning the function of the genome. The latest External Review of the Department of Molecular Biology and Biochemistry (2012) recognized departmental research excellence in genomics but recommended against implementing a proposed majors/honours B.Sc. program in genomics (previously approved as an NOI). Instead, the department is proposing to create a Certificate in Genomics. The NOI has been reviewed and approved by SCUP and here we present the full program proposal for a Certificate in Genomics

Full Program Proposal
Certificate in Genomics
Department of Molecular Biology and Biochemistry
Simon Fraser University

Summary

- Genomics is a newly emerged discipline that is already having a profound influence on other life science disciplines, as well as clinical practice and biotechnology. Drawing upon its multidisciplinary roots in molecular genetics, chemistry, physics, computer science and engineering, genomics involves the generation and analysis of massive quantities of DNA and protein sequence data, as well as experimental information concerning the organization and function of the genome.
- The External Review of the Department of Molecular Biology and Biochemistry (2012) recognized departmental research excellence in genomics but recommended against implementing a proposed majors/honours B.Sc. program in genomics (previously approved by SCUP as an NOI). Instead, the department is proposing to create a Certificate in Genomics.
- The interdepartmental certificate program would be open to students in several majors programs.
- The required and elective courses for the program already exist and no new faculty hiring is required.
- Enrolment in relevant courses and surveys of undergraduate students at SFU indicate substantial interest in this program.
- The Department of Molecular Biology and Biochemistry (MBB) will administer the program.
- Graduates with the Genomics Certificate will find opportunities for:
 - Employment in Genome Sequencing Centres and other research, clinical, hospital, and government laboratories
 - Admission to professional schools
 - Admission to graduate programs in genomics and related areas

Background:

Genomics and the related disciplines of bioinformatics and proteomics are generating huge amounts of information that is becoming increasingly relevant to all Life Science disciplines. Genomics is also having a major impact on the pharmaceutical and biotechnology industries. Moreover, the rapidly declining cost of sequencing the entire genome of human patients is ushering in the era of personalized (also known as precision) medicine that is expected to revolutionize clinical diagnosis and treatment.

SFU has had an important role in the development of genomics in BC and Canada. For example, Marco Marra and Steven Jones, who received graduate training at SFU, have leadership roles at the Michael Smith Genome Sciences Centre (GSC) of Vancouver that is operated by the BC Cancer Agency. The GSC has become one of the leading centres for high throughput genomics in

the world, concentrating on cancer genomics. In recent years, MBB has hired several faculty members having expertise relevant to genomics: Fiona Brinkman, Frederic Pio, Jack Chen, and Ryan Morin. In addition, SFU has created joint (half-time) positions for 4 Senior Scientists at the GSC: Steve Jones (MBB), Sharon Gorski (MBB), Rob Holt (MBB), and Angie Brooks-Wilson (BPK). Most faculty in MBB use genomics tools in their research operations, as do some faculty in other departments at SFU. The 2012 External Review Committee concluded: "Over time, MBB has developed expertise in most aspects of genomics that place it apart from any comparable unit in Western Canada if not the entire country."

Recognizing this research strength and opportunity and the increasing importance of genomics, MBB previously submitted a Notice of Intent to create an interdepartmental major and honours B.Sc. program in genomics that would be unique in Canada (and probably North America); the NOI was approved by SCUP. The plan required the creation of several new courses, in particular an introductory genomics course. That course, MBB 242 Introduction to Genomics, was taught on a trial basis, but was found to lack suitable prerequisites. It has been converted to MBB 342 (Introductory Genomics and Bioinformatics), which was taught in 2013 for the first time on a trial basis (as a special topics course), and will be taught in 2014-1 on a continuing basis at least once per year. The MBB external review committee recommended against creating the Genomics major/honours program, but recommended that the concepts of genomics be incorporated into "MBB course offerings in a way that supports the greater Department vision for its program." MBB is working with other life science units to introduce more genomics content into introductory courses, but wants to take advantage of the strength of expertise and student interest in genomics at SFU. We are thus proposing to create this certificate program.

The proposed certificate program can be completed by many B.Sc. majors including MBB, Biological Sciences, Health Sciences, and Biomedical Physiology and Kinesiology. No new courses would be required to mount the program, though we anticipate that some suitable special topics courses will be created and may evolve into appropriate elective courses. The required courses are taught at least once per year (in most instances 2-3 times per year) and serve as prerequisites for higher-level courses. The elective courses are normally taught each year, but may be postponed for a year due to study leaves. With reasonable planning, students should be able to complete the necessary course work and their major programs with no delay or extra units. MBB will provide administrative and clerical support services. This program is expected to be unique in Canada and unusual in the world.

1. Credential to be awarded: Certificate in Genomics

2. **Location:** SFU, Burnaby Campus
3. **Faculty/Department offering the new program:** Faculty of Science/Department of Molecular Biology and Biochemistry
4. **Anticipated program start date:** May, 2014.
5. **Description of the proposed program**

a) Aims, goals, and/or objectives

Genomics involves the generation and analysis of large quantities of DNA and protein sequence data, as well as data concerning the function of the genome. It has important, evolving applications to nearly all aspects of the life sciences, especially with regard to biomedical and health research, clinical applications, and the biotechnology, pharmaceutical, agricultural and forestry industries. This program will help students develop skills in generating, analyzing and managing genomic data. It will also facilitate understanding the applications of genomics in the context of the more traditional life science disciplines.

b) Anticipated contribution to the mandate and strategic plan of the institution:

The program is a good fit with SFU's strategic research emphasis on interdisciplinary programs and recent emphasis on developing programs in the health sciences, including genomics. It takes advantage of SFU's strategic initiative to participate in creating a regional Genome Sciences Institute involving scientists at the world class BC Cancer Agency's Genomes Sciences Centre (GSC) of Vancouver. Four senior scientists at the GSC hold joint faculty positions at SFU and they will participate in this teaching program. They join the CRC Tier 1 in Genomics Professor David Baillie and other SFU scientists having research programs in genomics and related disciplines.

The program responds to student interest in an area of research strength at SFU (as acknowledged by the 2012 External Review of MBB). Genomics and its applications provide opportunities for public and workplace community engagement activities. The program will generate future employees able to help translate their knowledge into new developments in the private and public sectors.

c) Target audience:

The program is expected to attract students who have been captivated by the highly publicized scientific and professional opportunities generated by genomics, a rapidly maturing discipline that did not exist 15 years ago. It will provide excellent preparation for medical and other professional and graduate degree programs. It will also provide appropriate training for a growing

number of technical positions in genome sequencing centres and related laboratories, especially for students taking advantage of co-curricular experiential learning.

d) Content:

The Genomics Certificate program will require 30 units including 12 lower division and 9 upper division required course units plus 9 units selected from a list of electives.

Prerequisite and Required Course Grades

Students enrolling in MBB courses must have a grade of C or better in prerequisite courses for upper division courses. Students enrolled in this certificate program must have a grade of C- or better in, and must have a minimum of a 2.0 grade point average (GPA) calculated on, all required courses (including those selected from the list of electives).

Program Requirements

Lower Division Courses:

MBB 222-3 Molecular Biology and Biochemistry*
MBB 231-3 Cellular Biology and Biochemistry*
BISC 202-3 Genetics*

And one of the following:

STAT 201-3 Statistics for the Life Sciences
STAT 270-3 Introduction to Probability and Statistics*

Upper Division Courses:

MBB 331-3 Molecular Biology
MBB 342-3 Introductory Genomics and Bioinformatics^

And one of the following:

MBB 308-3 Molecular Biology Laboratory
BISC 357-3 Gene Cloning

And 9 units selected from the following list:

MBB 435-3 Genome Biology
MBB 441-3 Bioinformatics
MBB 442-3 Proteomics
MBB 461-3 Comparative Genomics
MBB 462-3 Human Genomics
MBB 420-3 Selected Topics in Contemporary Biochemistry#
MBB 440-3 Selected Topics in Contemporary Molecular Biology#
BISC 471-3, 472-3, 473-3 Special Topics in Biology#

* Courses require additional prerequisites

^ Course requires an introductory Computer Science Course as a pre-requisite

Course must be in an area related to genomics and must be approved by the MBB program coordinator.

e) Delivery methods:

Lectures, computer laboratories, peer group discussions and exercises, visits to the GSC, guest lectures from genomics experts, tutorials (and wet laboratories included in majors programs).

f) Linkages between educational goals and curriculum design:

Students receiving the certificate will be able to: appreciate the major concepts and discoveries of genomics and how they relate to the broader life and biomedical sciences; understand the central methods of genomic research and their applications; read, evaluate, and report on primary research papers concerning genomics; prepare written reports and make oral presentations about the genome sciences and their applications to related disciplines; solve problems involving genomic data; and appreciate the privacy and ethical issues related to genomics research. These outcomes will be achieved via the specialized courses in the certificate program as well as the course work in the students' majors programs, including the WQB courses. Students will obtain hands-on laboratory and computational experience with some of the methods of genomics and bioinformatics and will have the opportunity to participate in Co-op work terms and/or independent research courses. A work experience is not required, but work and/or independent research projects will be encouraged for qualified students. Many research laboratories at SFU can provide research opportunities related to genomics.

g) Distinctive characteristics:

The required lower division courses are included in the core curriculum of many students majoring in MBB, Biological Sciences, Biomedical Physiology and Kinesiology, and the Faculty of Health Sciences. The distinctive feature of the program is the inclusion of 5 specialized courses related to genomics. The required introductory course MBB 342 is not required in any other program at SFU. The program is distinct from any other certificate program at SFU. There are no other undergraduate genomics major or credential programs in British Columbia.

h) Anticipated completion time:

Four years (8 semesters, 120 units) in an appropriate major program with the certificate (for students not doing Co-op). By appropriate planning and selection of required and elective courses, this program can be completed within the B.Sc. with no additional unit requirements by students majoring in Molecular Biology and Biochemistry or the MBB joint major program offered with Computing Science. Students in the MBB joint major program with

Chemistry; the Cells, Molecules and Physiology stream of Biological Sciences; the B.Sc. program in the Faculty of Health Sciences; and the Biomedical Physiology stream of BPK will also be able to complete the certificate but will need at a minimum to complete an introductory course in Computer Science as a prerequisite for MBB 342 that is not otherwise part of the requirements for their major program.

i) Enrolment plan:

Students may declare an intention to complete the certificate at any time prior to applying to graduate. Because the lower division requirements are part of the life sciences undergraduate curriculum, students will not need to decide to enter the certificate program until their third or fourth years.

j) Policies on student evaluation:

As per general regulations of SFU and the Faculty of Science. Depending on the course, students will be evaluated on their performance on tests, exams, problem sets, written reports, laboratory or computational exercises, term papers and assignments, in-class presentations, and participation in class discussions.

k) Policies on faculty appointment (degree requirements):

Continuing faculty will hold a Ph.D. or equivalent and have an appropriate research record relevant to genomics.

l) Policies on program assessment:

All academic units and programs at SFU are externally reviewed every seventh year.

m) Level of support and recognition from other post-secondary institutions (including plans for admissions and transfer within the BC post-secondary education system) and relevant regulatory or professional bodies, where applicable:

Students may transfer from other BC colleges or universities with transfer of course units based on the Articulation Criteria of the BC Council on Admissions and Transfer. Transfer after the completion of lower division equivalents should allow completion of the Certificate program. There is no applicable regulatory or professional body for Genomics in BC or Canada.

n) Evidence for student interest and labour market demand:

The specialized genomics courses in the program (MBB 435, 441, 442, 461, and 462) have attracted enrolments ranging from 15-80 in the past few years. Students have generally been quite satisfied with the quality of the courses, based on course evaluations and direct feedback. The introductory genomics course (MBB 342) was taught in 2013-1 by Fiona Brinkman as a special topics course having an enrolment of 48; it received favourable reviews from students. In 2012-3 students enrolled in MBB 441 and 462 were surveyed

about whether they would have been interested in the certificate program had it been offered. Half of the 28 students in 441 and nearly all of the 32 students in 462 said they were interested and expressed enthusiasm for the initiative. Thus, there is substantial student interest in the proposed program and its associated courses.

Anecdotal responses from genome scientists at universities and genome centres in Canada indicate that there is a need for such a program and that SFU would be in the enviable position of having created the first one in Canada. We thus anticipate that the program will attract excellent students to SFU because of its unique and timely appeal.

As a recently emerged discipline, genomics has not been surveyed by government agencies responsible for assessing employment opportunities. The National Human Genome Research Institute of the National Institutes of Health (USA) maintains a list of careers requiring expertise in genomics (<http://www.genome.gov/genomicCareers/careers.cfm>). It projects that most genomics-related careers have better than average income and growth potential. The proposed certificate program will help prepare students for employment in genomics centres, which are proliferating and expanding across Canada and the world.

The GSC continues to grow and provide employment opportunities (and has hired many SFU graduates). Of 157 non-professional employees at the GSC, 77 have only B.Sc. degrees, while most of the others have higher degrees. Graduates of the proposed program may find employment opportunities in the pharmaceutical and biotechnology industries that are investing heavily in genomics research, or they may pursue related graduate studies or entry into professional programs such as medicine, business or law where their specialized expertise will provide opportunities. With the advent of high throughput, inexpensive sequencing technologies, a transformative era of personalized genomics applied to the health of patients is beginning. We anticipate there will develop considerable demand in hospitals, public health agencies, and diagnostic and forensic laboratories for employees having sophisticated understanding of genomics and bioinformatics.

UBC recently created a Graduate Program in Genome Science and Technology (GSAT) funded in part by the NSERC CREATE grant program; it might attract SFU graduates holding the certificate. The GSAT provides summer session studentships for undergraduates that may be available to students in the SFU certificate program. SFU graduates holding the certificate may also apply for the graduate program in Health Bioinformatics jointly operated by SFU, UBC, and the BCCA.

o) Summary of resources required and available to implement the program:

The program depends on existing courses, though it is anticipated that the enrolment in those courses will increase from growth related to the program. We anticipate that the BISC special topics course Applied Genomics taught by Jim Mattsson will become a continuing course that will be included among the electives. Other new courses may be added to the program or replace existing courses depending on new staffing opportunities and knowledge fronts. New courses are usually initially offered as special topics courses. When appropriate, these courses can be used to satisfy the program elective requirements if approved by MBB.

There is no anticipated additional cost to SFU to implement the certificate program. If it attracts expansionary enrolment, as anticipated, there will be attendant costs (e.g., TA support, supplies for laboratory courses) for accommodating increased numbers of students in the courses included in the program. MBB will provide the minimal administrative and clerical support required for the program.

p) Programs and resources that will be eliminated by introduction of the new program: not applicable

q) SFU faculty involved in teaching the program:

The courses required for completion of the program are already taught and should not require additional faculty. There is sufficient flexibility in the program that a need for increased frequency of course offering is not anticipated unless enrolments increase substantially (MBB already plans to increase the frequency of MBB 331 from 2 to 3 semesters per year). Faculty having appropriate expertise to teach courses in the program include David Baillie, Fiona Brinkman, Jack Chen, Ryan Morin, Frederic Pio, Sharon Gorski, Robert Holt, and Steven Jones in MBB; Angela Brooks-Wilson in BPK; and Jim Mattsson in Biosciences.

r) Premium fees: not applicable.

s) Related programs at SFU and other BC post-secondary institutions:
We are not aware of any undergraduate genomics programs in BC or Canada.

6. Additional information required by SFU:

a) Contact information for the faculty members responsible for program development:

Ingrid Northwood, Molecular Biology and Biochemistry, inorthwo@sfu.ca
Bruce Brandhorst, Molecular Biology and Biochemistry, brandhor@sfu.ca
Lynne Quarmby, Molecular Biology and Biochemistry, quarmby@sfu.ca

The following would be the Calendar entry for this program:

Genomics Certificate Program

The Genomics Certificate Program includes 30 units, 21 of which are required with the remaining 9 selected from a list of electives.

Admission Requirements.

Admission is governed by the University's admissions regulations. After University admission, approval of the Molecular Biology and Biochemistry (MBB) Program Coordinator is required for formal acceptance into the program. This may be done anytime before graduation, but is recommended upon completion of MBB 342. The certificate can be completed by students in various major programs that use the life sciences undergraduate core curriculum for the lower division requirements. Credits applied to one certificate may not be applied to another certificate or diploma.

Prerequisite and Required Course Grades

Students enrolling in upper division MBB courses must have a grade of C or better in prerequisite courses. Students enrolled in this certificate program must have a grade of C- or better in all required courses (including those selected from the list of electives) to graduate with this certificate.

Program Requirements

Students must have a minimum 2.0 grade point average (GPA) calculated on all required courses (including those selected from the list of electives).

Students must complete all of:

MBB 222 Molecular Biology and Biochemistry (3) *
MBB 231 Cellular Biology and Biochemistry (3) *
BISC 202 Genetics (3) *
MBB 331 Molecular Biology (3)
MBB 342 Introductory Genomics and Bioinformatics *(3)

And one of

MBB 308 Molecular Biology Laboratory (3)
BISC 357 Gene Cloning (3)

And one of

STAT 201 Statistics for the Life Sciences
STAT 270 Introduction to Probability and Statistics*

And three of

MBB 435 Genome Biology
MBB 441 Bioinformatics
MBB 442 Proteomics
MBB 461 Comparative Genomics
MBB 462 Human Genomics
MBB 420 Selected Topics in Contemporary Biochemistry#
MBB 440 Selected Topics in Contemporary Molecular Biology#
BISC 471-473 Special Topics in Biology#

* courses require additional prerequisites

course must be in an area related to genomics and must be approved by the MBB academic advisor