Dear Dr. Kelly,

As a follow up to our meeting on Wednesday, I set up a conference call with the rest of the Pathways Biology Major Committee. After much discussion, the committee decided that it was not possible to define a precise course syllabus for each of the two semester biology courses for the major. The reason for this conclusion is described in the following. I also included another copy of our initial report.

Respectfully yours,

Charles R. Kramer

Chair
There is a request to mandate a division of course material between the two semesters of the year long introductory major's Biology course. The stated goal is to make easy and automatic a mid-year transfer of half of the coursework (a single semester) between campuses. Our committee did not support this idea for the various reasons stated in our report. For students who do not end up pursuing a Biology major, there should be no impediment to a single-semester transfer, because such students will likely not be taking a second semester of Introductory Biology, nor any further major courses in biology. The one semester can be applied to the common or flexible core requirements and be considered a rigorous, substantive one-semester Biology experience.

The case of a would-be Biology major, who will be pursuing further coursework that builds on the introductory year, is considerably different. The event of such a student who is taking a year long introductory major's Biology course sequence, and then elects a mid-year transfer between campuses in the middle of the sequence, should be exceedingly rare, if students are properly advised. The request to mandate a CUNY-wide uniform division of material between the two semesters is ostensibly to make automatic a transfer of one half of the coursework between campuses. We suggest an alternative way to facilitate such a rare and unadvisable one-semester transfer. This alternative focuses on proper student advising, and a student's individual responsibility for their own decisions. This alternative also respects the expertise and best advice of College Biology Professors, and the varying research/teaching foci, strengths and missions of the many CUNY departments that offer introductory major's Biology.

In that extremely rare case, the student's Biology advisors on the new campus would need to make an individual assessment of what any gaps will remain in the student's coursework after completion of the second semester on the new campus. That missing material will need to be made up in a subsequent semester. This could involve attending the set of lectures in which the missing material will be covered, or independent reading and evaluation directed by an appropriate faculty instructor. If the makeup material must carry academic credit, then it can go on the student's course record as an individual tutorial or independent study course number and count as overall elective credit for the student. After completion of this material, the initial one semester of coursework can transfer.

The entire year of material is an integrated whole. The topics can be effectively sequenced and integrated in various ways. These decisions are best left to the College-level Biology Professors who are wholly responsible for their own courses. To mandate a sequence of material is to force more insidious encumbrances on the instructor's presentation and integration of that material. We find this unacceptable at the College level. Rather, prospective Biology major students should be properly advised to complete the entire course (both semesters) of introductory biology on the same campus for numerous practical and pedagogical reasons. It is the best way to present the year of material as an integrated whole, in order to foster student integration and application of the key concepts. This critical learning goal is the essence of what distinguishes College-level introductory major's biology from high school and non-major courses. Condoning the automatic transfer of one half of an integrated one-year course completely invalidates the intent of this learning goal.

We disagree with setting conditions that would serve to normalize and even encourage mid-year transfers of half of the introductory majors biology coursework. We believe the Pathways initiative should rather set a standard of student preparedness, an environment of faculty responsibility for proper student advising and student responsibility for their own decisions. This is what our committee has accomplished and recommended to CUNY. We believe these are the appropriate conditions for facilitating transfer and, above all, welcoming students to the pursuit of our discipline.
Final Recommendation
Pathways Biology Major Committee

Members: Charles Kramer (chair), College of Staten Island
        Stephane Boissinot, Queens College
        Mary Beth Dawson, Kingsborough Community College
        Patricia Ferdinand, Medgar Evers College
        Benjamin Ortiz, Hunter College
        Juergen Polle, Brooklyn College
        Sarah Salm, Borough of Manhattan Community College

March 1, 2012
Preamble:

The CUNY Central Administration convened a committee of Biology Faculty members. Our charge was to provide CUNY-wide guidelines for preparation and advising of students who wish to begin, or continue, a Biology major curriculum after transfer between CUNY units. The goal is to ensure that introductory courses designed for Biology majors (whether or not such courses are a formal part of the major requirements) will be accepted for transfer credit throughout CUNY. Committee members were selected from those CUNY campuses with the greatest number of transfer students (either in or out) who pursue a major in Biology, via recommendation from their home campuses, pending final approval by CUNY. The committee consisted of Professors Charles Kramer, College of Staten Island (Chair); Stephane Boissinot, Queens College; Mary Beth Dawson, Kingsborough Community College; Patricia Ferdinand, Medgar Evers College; Jürgen Polle, Brooklyn College; Sarah Salm, Borough of Manhattan Community College and Ben Ortiz, Hunter College.

The committee met monthly along with intervening e-mail communications from October 2011 through February 2012, engaging in an on-going, comprehensive discussion of how to ensure ease of transfer for Biology majors within CUNY. The obvious point of focus for us in these discussions was the yearlong introductory "Major’s" Biology course of study. Introductory major’s Biology consists of two semesters of lecture and two semesters of lab for a total of at least eight credits and twelve hours. At the start of the process, the committee collected syllabi for the introductory courses for Biology majors from all 17 undergraduate CUNY campuses. The intention was to make this process as inclusive as possible. After careful consideration of each department’s syllabi and (where available) learning outcomes, a topical outline and a set of learning outcomes were assembled.

The committee concluded that the major difference between “majors” and “non-majors” introductory biology was the former’s much broader scope, breadth and depth of topics covered. Accordingly the outlines of topics and goals are enormous in their scope. There are numerous, valid, effective and exciting ways to organize and sequence the material during the year of introductory major’s biology. Therefore, we believe it is important not to mandate any specific order or distribution of topics, either between the two semesters, or between the lecture and laboratory components. Instead, we compiled the complete set of topics that we agree ought to be typically covered over the two semesters (both lecture and laboratory courses) for first year Majors in Biology. The intention is for these topics to be covered in a minimum total of 8 credits/12 hours, over two semesters. To ensure complete preparation, and avoid undue repetition of material, students MUST complete this full year of courses (lecture and laboratory) at the same unit of CUNY, with a grade of C or better, in order to be eligible for transfer credit.

Individual instructors should have no reservations about adding to the topic list, and emphases within topics and subtopics headings are at the discretion of the instructor. However, we feel that the scope and breadth of this course must be preserved to ensure that upon transfer, students will be prepared to begin advanced major coursework.

Below follows an outline of major topic headings: (Note: the topic order is not meant to indicate or mandate a particular sequence of course material. We re-affirm that an instructor’s academic freedom affords them the liberty to order the course materials so as to most effectively infuse it with their own understanding, expertise and enthusiasm).
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Introductory “Major’s” Biology (minimum total of 8 credits/12 hours)
Typically covered over two semesters of both Lecture and Lab courses

Outline of major topic headings: (Note: the topic order is not meant to indicate or mandate a particular sequence of course material. An instructor’s academic freedom affords them the liberty to order the course materials so as to infuse it with their own understanding, expertise and enthusiasm).

I. The Scientific Method as Applied to Biological Investigations

II. Chemical Context of Life
   A. Atoms, molecules, bonds and isotopes
   B. Water, pH, Buffers
   C. Chemical reactions
   D. Biological molecules

III. Cell Biology: Prokaryotes, Eukaryotes
   A. History of Cell Biology and types of microscopy
   B. Membrane physiology and signal transduction
   C. Cell structure and function
      1. Cytoskeleton components and function
      2. Cytoplasmic organelles and roles
      3. Structure and function in the nucleus
   D. Cell cycle, regulation
      1. Cell division, mitosis in animal and plant cells
      2. Meiosis and gametogenesis in animals
      3. Stem cells and cellular differentiation
      4. Cell death/Apoptosis

IV. Homeostasis of Cells, Tissues, and Organ systems
   A. Hierarchy of Organization
      1. Cells as the Units of Life
      2. Cellular compartmentalization
   B. Biochemistry and physiology of metabolism
      1. The nature of energy and its changes within the cell
      2. Enzymes and their importance to metabolic reactions within the cell
      3. Capture of energy, Photosynthesis
      4. Energy release in glycolysis and respiration
      5. Cellular oxidation in prokaryotes
   C. Tissues
      1. Structure and function of major tissue types
      2. Form and function are correlated at all levels of organization
   D. Homeostasis of animal organs and organ systems
      1. Homeostatic Mechanisms at the Organism Level
      2. Nutrition
      3. Circulation & Gas Exchange
      4. Osmoregulation & Excretion
      5. Hormones
      6. Nervous Systems
      7. Sensory & Motor Mechanisms
      8. Reproduction & Development
      9. Immune System
V. Genetics
   A. Structure of DNA and RNA
   B. Mechanisms of inheritance
      1. Mendel's laws of inheritance
      2. Human genetics
   C. Molecular Genetics
      1. DNA replication
      2. DNA mutagenesis and repair
   D. Introduction to genetic engineering and biotechnology

VI. Gene Expression and Central Dogma
   A. Main functional components of a gene
      1. Exons, introns, promoters
      2. Histones and chromatin packaging
   B. Transcription
      1. RNA polymerase structure and function
      2. Similarities, differences and relationship between DNA and mRNA
      3. Exon splicing
      4. 5' and 3' UTRs
   C. Translation
      1. Codons, tRNA and ribosomes
   D. Regulation of gene expression
      1. Transcriptional Regulation
      2. Post-transcriptional regulation
      3. Translational regulation
      4. Epigenetics and chromatin regulation

VII. Evolution - historically and as an overarching concept of modern biology
   A. Mechanisms of evolutionary changes
      1. Variation
      2. Natural selection
      3. Genetic drift and gene flow
   B. Species and speciation
      1. What is a species?
      2. How are species formed?
   C. Time scale of life on earth
   D. Classification and Phylogenetics

VIII. Survey of the Diversity of Life
   A. Diversity of unicellular life
      1. Viruses
      2. Prokaryotes
       a. Bacteria and Archaea
      3. Protists
   B. Plants
      1. The origin of plants
      2. Survey of plant diversity
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a. Mosses
b. Ferns
c. Gymnosperms
d. Angiosperms

3. Plant physiology
   a. The plant cell
   b. General anatomy of plants
   c. Plant growth
   d. Plant reproduction and development
   e. Plant nutrition, circulation, gas exchange, and hormones

C. Animals
   1. The origin of animals
   2. Animal early development
   3. Groups to be covered
      a. Porifera
      b. Cnidarians
      c. Protostomes
         i. Ecdysozoans
            Arthropods
            Nematodes
         ii. Lophotrochozoans
            Flatworms
            Mollusks
            Annelids
      d. Deuterostomes
         i. Echinoderms
         ii. Vertebrates

D. Fungi

IX. Ecology
A. The biosphere
   1. Climates
   2. Biomes

B. Population ecology
   1. Evolution of life history traits
   2. Population growth

C. Community ecology
   1. Interactions: competition, predation, symbiosis, parasitism, and commensalism
   2. Community structure
   3. Trophic structure

D. Ecosystems
   1. Transfer of energy
   2. Water cycle
   3. Nutrient cycles (Carbon, Nitrogen, Phosphorus)
Learning Goals for Introductory "Major's" Biology (minimum total of 8 credits/12 hours)
Typically covered over two semesters of both Lecture and Lab courses

Overall learning goals:

1. The major overall learning goal of 1st year majors Biology is for students to develop a deep and broad integrated working knowledge base in Biology, enabling them to understand, inter-relate and apply the key concepts of the field. As such, these courses should include continual emphases on the many obvious points of integration among the topics and subtopics listed under different headings. College Biology Professors are well placed (and are strongly encouraged) to go "beyond the textbook" to achieve and assess this goal. Introduction of level-appropriate and accessible research articles, integrative problem sets and/or hands-on application of concepts in lab exercises are some suggested ways to foster knowledge integration and application in students pursuing the Biological Sciences.

In addition:

2. Students will develop a thorough understanding of, and ability to apply, the scientific method

3. Students will understand and be able to inter-relate, biological processes at the molecular, sub-cellular, cellular, tissue, organ, organ system, organismal, population and ecosystem levels

4. Students will develop a broad understanding of evolution and the unity and diversity of life

5. Students will acquire a thorough understanding of the mechanisms enabling inheritance and the transmission of biological information

6. Students will be able to relate and apply biological concepts to challenges in today's world

Learning outcomes of major topic headings:

(Note: the topic order is not meant to indicate or mandate a particular sequence of course material. An instructor's academic freedom affords them the liberty to order the course materials so as to infuse it with their own understanding, expertise and enthusiasm).

I. The Scientific Method as Applied to Biological Investigations
   A. Students will understand and apply experimental design concepts including:
      1. Derivation and testing of hypotheses
      2. Selection of appropriate controls

II. Chemical Context of Life
   A. Understand the various states and combinations of matter, and the types of energy.
   B. Explain the various subatomic particles, and how they are used to determine atomic mass and weight.
   C. Apply their knowledge of ions and valence electrons to understand and explain the types of chemical bonds.
   D. Understand and explain the unique chemical and physical properties of water.
   E. Describe the three major types of mixtures: suspensions, colloidal dispersions, and true solutions.
   F. Understand the various ways of expressing concentrations of solutions.
   G. Define acid, base, pH, the term buffer and explain how a buffer works.
   H. Use simple equations to explain the major types of chemical reactions.
I. Explain the effect of various factors on the rate of chemical reactions.
J. Understand the structures and functions of the major types of biological macromolecules: proteins, glycoproteins, simple and complex carbohydrates, lipids, phospholipids, steroids and nucleic acids

III. Cell Biology: Prokaryotes, Eukaryotes
A. Understand the history and microscopic methods of cell visualization
B. Understand the structure and function of the major components, intracellular structures and organelles of cells, both Prokaryotic and Eukaryotic
C. Understand the functions of membrane proteins in cell integrity, homeostasis and signal transduction
D. Understand structure-function relationships in the nucleus
E. Understand the components and functions of the cytoskeleton
F. Understand the types of junctions that link cells together into tissues and organs
G. Understand the relationships between, and importance of, germ cells, somatic cells and stem cells.
H. Understand mitosis, meiosis, gametogenesis and fertilization
I. Understand control of cell division/cell cycle and its regulation by chemical signals
J. Understand the various roles of apoptosis throughout the life cycle of an organism

IV. Homeostasis of Cells, Tissues and Organ Systems
A. Understand the hierarchy of organization in the body from cells to organism
B. Understand what is meant by fluid compartmentalization (i.e. intracellular and extracellular fluids)
C. Describe the chemical and physical nature of the intracellular fluids (ICF) and extracellular fluids (ECF)
D. Define the internal environment and the interchange between ICF and ECF
E. Discuss the significance of maintaining a steady state of the internal environment, including homeostatic mechanisms and systems
F. Describe the homeostatic functions of the organ systems of the body

V. Genetics
A. Understand the helical and anti-parallel structure of DNA and semi-conservative DNA replication as well as RNA structure and complementarity.
B. Explain the evidence that DNA is the genetic molecule, and understand the chromosomal basis of inheritance.
C. Understand Mendel's laws of inheritance and define and know genetic terms such as alleles, genotype, phenotype, dominance, epistasis and pleiotropy.
D. Understand and apply the use of the Punnett square and demonstrate the outcomes of testcrosses.
E. Understand how to read and make human pedigrees, and understand polygenic inheritance and multiple alleles.
F. Understand Morgan's Drosophila work and the inheritance of linked genes (including sex-linked genes) and crossing over.
G. Understand mutations and describe human diseases caused by mutation (e.g. Tay Sachs, sickle cell disease, Huntington's disease, cystic fibrosis, albinism, and breast cancer)
H. Explain recent advances in molecular biology, including the multiple roles of non-coding RNAs and evolution of genes.

VI. Gene Expression and Central Dogma
A. Understand that a gene is more than just the segments that encode the protein and why
B. Understand that genes reside on DNA that exists in a complex chromatin packaging
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C. Understand that transcription and translation are the required, enzymatic steps for the use of genetic information to achieve cellular functions and organism phenotype.

D. Understand that the phenotypic and functional expression of genetic information can be regulated (i.e. turned on/off and/or fine tuned) at many levels and/or via many mechanisms along the path from DNA → RNA → protein.

VII. Evolution - historically and as an overarching concept of modern biology

A. Understand that evolution is a process that is taking place in populations at the level of the gene.

B. Understand evolution as a change in allelic frequency.

C. Understand that species are biological entities and that geography has played a major role in the diversification of organisms.

D. Understand that evolution is a cumulative process and the timescales of evolutionary change.

E. Understand that the Earth and its environment have changed considerably over time.

D. Understand the way organisms are classified and be able to interpret phylogenetic trees.

VIII. Survey of the Diversity of Life

A. Describe the distinguishing characteristics of the principal groups of organisms.

B. Understand the diversity of life in an evolutionary framework.

C. Understand the diversity of life in terms of life cycles.

D. Understand the diversity of plants in terms of reproductive biology.

E. Describe the general anatomy of plants and understand their physiology.

F. Understand the diversity of animals in terms of early development and evolutionary affinities.

G. Understand the ecological role and significance of the major groups of organisms.

IX. Ecology

A. Understand the relationships between abiotic and biotic factors within an ecosystem.

B. Understand the factors that are affecting the distribution of organisms in the biosphere and describe the main types of biomes.

C. Define demography and understand the factors affecting population growth.

D. Define the different types of interactions among organisms.

E. Understand relationships within ecosystems with respect to food chains.

F. Understand that energy and matter are circulating in the biosphere and that living organisms play an essential role in these cycles.

G. Understand the effects of human activities on ecosystems, the biosphere and ourselves.
Concluding remarks and recommendations:

Throughout the course of our discussions, several key issues related to Biology majors transferring within CUNY were identified and discussed. Our recommendations on these issues follow:

a. Regarding the latest communication from Vice Chancellor Logue on the CUNY Credit for Common Core (and Other) Science Laboratories (January 25th, 2012) in which suggestions were made as to how CUNY schools can “create” lecture and lab courses that meet the novel 3-credit/3 hour constraints of the proposed common core science requirements, the committee states the following:

Under no circumstances should classes offered to biology major students be reduced in hours or content from the traditional minimum of 4 – 4.5 credit/6 hr lecture & lab format. In addition, the committee recommends that non-science major students, if they wish, should be afforded the opportunity meet their common core science requirement with a traditional 4 – 4.5 credit science class in lieu of any “novel format” 3 credit/3 hour course.

b. If a student intends to transfer to a new campus to begin a Biology major curriculum, s/he must be advised to have completed the following courses prior to transfer:

   i. One year of Introductory Biology for science majors, 8 credits minimum, including lecture and laboratory all taken at the same unit of CUNY. The lecture and lab components may be linked in single courses (e.g., BIOL100 and BIOL 102 at Hunter College and Bio 210 and Bio 220 from BMCC) or offered as separate, co-requisite courses (e.g., Bio 170/171 and Bio 180/181 at CSI).

   ii. A minimum of one year of majors General Chemistry (e.g., CHEM 102 and CHEM 104 from Hunter College)

   iii. A minimum of one semester of pre-calculus mathematics.

c. Any grade lower than “C” in Introductory “Majors” Biology courses should not be accepted for transfer. The rationale being that the committee believes it will be a disservice to allow a student who has not yet fully mastered the foundational material to move ahead in the major.

d. While the AP Biology course can provide excellent preparation for a college level major’s biology course, the consensus of the committee is that AP course work should not be considered as an equivalent to 1st year Introductory “major’s” Biology.