

**1. General Information**

1a. Submitted by the College of: PUBLIC HEALTH

Date Submitted: 10/22/2014

1b. Department/Division: Dept Of Biostatistics

1c. Contact Person

Name: Andrea Perkins

Email: andrea.perkins@uky.edu

Phone: 218-2021

Responsible Faculty ID (if different from Contact)

Name: Radha Nagarajan

Email: rnagarajan@uky.edu

Phone: 218-0109

1d. Requested Effective Date: Semester following approval

1e. Should this course be a UK Core Course? No

**2. Designation and Description of Proposed Course**

2a. Will this course also be offered through Distance Learning?: Yes<sup>4</sup>

2b. Prefix and Number: BMI 633

2c. Full Title: Introduction to Bioinformatics

2d. Transcript Title:

2e. Cross-listing:

2f. Meeting Patterns

LECTURE: 45

2g. Grading System: Letter (A, B, C, etc.)

2h. Number of credit hours: 3

2i. Is this course repeatable for additional credit? No

If Yes: Maximum number of credit hours:

If Yes: Will this course allow multiple registrations during the same semester?

2j. Course Description for Bulletin: This is an introductory course aimed at a multi-disciplinary audience with an interest in applying the principles of information sciences for obtaining insight into biological processes and systems that can eventually be used to make informed decisions.

**RECEIVED**

NOV 7 2014

OFFICE OF THE  
SENATE COUNCIL

2k. Prerequisites, if any: None

2l. Supplementary Teaching Component:

3. Will this course taught off campus? No

If YES, enter the off campus address:

4. Frequency of Course Offering: Fall,

Will the course be offered every year?: Yes

If No, explain:

5. Are facilities and personnel necessary for the proposed new course available?: Yes

If No, explain:

6. What enrollment (per section per semester) may reasonably be expected?: 25

7. Anticipated Student Demand

Will this course serve students primarily within the degree program?: No

Will it be of interest to a significant number of students outside the degree pgm?: Yes

If Yes, explain: The recent surge of high-throughput molecular data from biological settings generated from distinct biological and physiological systems and emphasis on translational research will be taught in the present course and is expected to appeal to a wide audience from Colleges of Medicine, Health Sciences, Public Health and Agriculture.

8. Check the category most applicable to this course: Relatively New – Now Being Widely Established,

If No, explain:

9. Course Relationship to Program(s).

a. Is this course part of a proposed new program?: No

If YES, name the proposed new program:

b. Will this course be a new requirement for ANY program?: No

If YES, list affected programs:

10. Information to be Placed on Syllabus.

a. Is the course 400G or 500?: No

b. The syllabus, including course description, student learning outcomes, and grading policies (and 400G-/500-level grading differentiation if applicable, from **10.a** above) are attached: Yes

## **Distance Learning Form**

Instructor Name: Radha Nagarajan

Instructor Email: rnagarajan@uky.edu

Internet/Web-based: Yes

Interactive Video: No

Hybrid: No

1. How does this course provide for timely and appropriate interaction between students and faculty and among students? Does the course syllabus conform to University Senate Syllabus Guidelines, specifically the Distance Learning Considerations? This course provides timely interaction between students and faculty through blackboard emailing, UK emails, Blackboard announcement, and discussion boards. In addition, AdobeConnect will be used to communicate with students on a live mode. Yes, this course syllabus conforms to the UK guidelines specific to the distance learning consideration.

2. How do you ensure that the experience for a DL student is comparable to that of a classroom-based student's experience? Aspects to explore: textbooks, course goals, assessment of student learning outcomes, etc. All aspects of the class materials and instruction including instructional course goals and assessment of student learning outcomes will be the same if the course is offered in the classroom based setting.

3. How is the integrity of student work ensured? Please speak to aspects such as password-protected course portals, proctors for exams at interactive video sites; academic offense policy; etc. Blackboard is password protected and the instructor will make sure to handle personal student matters as cautiously as possible. Time-stamped materials will be used to make sure the integrity of the students work.

4. Will offering this course via DL result in at least 25% or at least 50% (based on total credit hours required for completion) of a degree program being offered via any form of DL, as defined above? No

If yes, which percentage, and which program(s)? N/A

5. How are students taking the course via DL assured of equivalent access to student services, similar to that of a student taking the class in a traditional classroom setting? The instructor will maintain both an off line and an online office hour on a regular basis.

6. How do course requirements ensure that students make appropriate use of learning resources? The video clips that are carefully chosen to supplement course lecture slides will be provided for further discussions. Practical exercise driven assignments will be given to students to achieve learning goals to assess/review essential contents in bioinformatics.

7. Please explain specifically how access is provided to laboratories, facilities, and equipment appropriate to the course or program. All the readings assigned will be available based on free access or otherwise university licensed-articles. Learning tools and databases assigned for practical exercises will be available on a publicly accessible database, otherwise university licensed product through UK library system.

8. How are students informed of procedures for resolving technical complaints? Does the syllabus list the entities available to offer technical help with the delivery and/or receipt of the course, such as the Information Technology Customer Service Center (<http://www.uky.edu/UKIT/>)? Yes. Additional resources for resolving technical issues are stated on the syllabus, including instructions to notify the instructor immediately.

9. Will the course be delivered via services available through the Distance Learning Program (DLP) and the Academic Technology Group (ATL)? YES

If no, explain how student enrolled in DL courses are able to use the technology employed, as well as how students will be provided with assistance in using said technology. N/A

10. Does the syllabus contain all the required components? YES

11. I, the instructor of record, have read and understood all of the university-level statements regarding DL.

Instructor Name: Radhakrishnan Nagarajan

SIGNATURE|ALHAYS0|Andrea L Perkins|BMI 633 NEW College Review|20140319

SIGNATURE|CHAPPELL|Joseph Chappell|BMI 633 ZCOURSE\_NEW Approval Returned to Dept|20140425

SIGNATURE|ZNNIKO0|Roshan N Nikou|BMI 633 NEW Graduate Council Review|20140425

SIGNATURE|JTHU222|Jeffrey T Huber|BMI 633 ZCOURSE\_NEW Approval Returned to Dept|20140428

SIGNATURE|ZNNIKO0|Roshan N Nikou|BMI 633 NEW Graduate Council Review|20140428

SIGNATURE|ZNNIKO0|Roshan N Nikou|BMI 633 NEW Graduate Council Review|20140428

SIGNATURE|ALHAYS0|Andrea L Perkins|BMI 633 ZCOURSE\_NEW Approval Returned to Dept|20140820

SIGNATURE|ALHAYS0|Andrea L Perkins|BMI 633 NEW College Review|20140811

SIGNATURE|ZNNIKO0|Roshan N Nikou|BMI 633 NEW Graduate Council Review|20141107

SIGNATURE|ALHAYS0|Andrea L Perkins|BMI 633 NEW College Review|20141022

SIGNATURE|ZNNIKO0|Roshan N Nikou|BMI 633 NEW Graduate Council Review|20141107

Courses	Request Tracking
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## New Course Form

<https://myuk.uky.edu/sap/bc/soap/rfc?services=>

[Open in full window to print or save](#)

Generate R

## Attachments:

[Browse...](#)

Upload File

ID	Attachment
Delete 3266	BMI 633 Syllabus InClass 2-10-14 (Radha).pdf
Delete 3267	BMI 633 Syllabus Online 2-10-14 (Radha).pdf
Delete 3541	CCTS Letters of Support.pdf

First 1 2 Last

Select saved project to retrieve...

Get New

(\*denotes required fields)

## 1. General Information

- a. \* Submitted by the College of:  Submission Date:
- b. \* Department/Division:
- c.
- \* Contact Person Name:  Email:  Phone:
- \* Responsible Faculty ID (if different from Contact):  Email:  Phone:
- d. \* Requested Effective Date:  Semester following approval OR  Specific Term/Year<sup>1</sup>
- e. Should this course be a UK Core Course?  Yes  No

## IF YES, check the areas that apply:

- Inquiry - Arts & Creativity  Composition & Communications - II
- Inquiry - Humanities  Quantitative Foundations
- Inquiry - Nat/Math/Phys Sci.  Statistical Inferential Reasoning
- Inquiry - Social Sciences  U.S. Citizenship, Community, Diversity
- Composition & Communications - I  Global Dynamics

## 2. Designation and Description of Proposed Course.

- a. \* Will this course also be offered through Distance Learning?  Yes  No
- b. \* Prefix and Number:
- c. \* Full Title:
- d. Transcript Title (if full title is more than 40 characters):
- e. To be Cross-Listed<sup>2</sup> with (Prefix and Number):
- f. \* Courses must be described by at least one of the meeting patterns below. Include number of actual contact hours<sup>3</sup> for each meeting pattern type.
- |   |  |                                 |                                 |
|---|--|---------------------------------|---------------------------------|
| <input type="text" value="45"/> Lecture | <input type="text"/> Laboratory <sup>1</sup> | <input type="text"/> Recitation | <input type="text"/> Discussion |
| <input type="text"/> Indep. Study       | <input type="text"/> Clinical                | <input type="text"/> Colloquium | <input type="text"/> Practicum  |
| <input type="text"/> Research           | <input type="text"/> Residency               | <input type="text"/> Seminar    | <input type="text"/> Studio     |
| <input type="text"/> Other              | If Other, Please explain:                    |                                 |                                 |
- g. \* Identify a grading system:
- Letter (A, B, C, etc.)
- Pass/Fail
- Medicine Numeric Grade (Non-medical students will receive a letter grade)
- Graduate School Grade Scale
- h. \* Number of credits:
- i. \* Is this course repeatable for additional credit?  Yes  No
- If YES: Maximum number of credit hours:
- If YES: Will this course allow multiple registrations during the same semester?  Yes  No

## j. \* Course Description for Bulletin:

This is an introductory course aimed at a multi-disciplinary audience with an interest in applying the principles of information sciences for obtaining insight into biological processes and systems that can eventually be used to make informed decisions.

## k. Prerequisites, if any:

None

l. Supplementary teaching component, if any:  Community-Based Experience  Service Learning  Both3. \* Will this course be taught off campus?  Yes  No

If YES, enter the off campus address:

## 4. Frequency of Course Offering:

a. \* Course will be offered (check all that apply):  Fall  Spring  Summer  Winter

b. \* Will the course be offered every year?  Yes  No

If No, explain:

5. \* Are facilities and personnel necessary for the proposed new course available?  Yes  No

If No, explain:

## 6. \* What enrollment (per section per semester) may reasonably be expected? 25

## 7. Anticipated Student Demand.

a. \* Will this course serve students primarily within the degree program?  Yes  No

b. \* Will it be of interest to a significant number of students outside the degree pgm?  Yes  No

If YES, explain:

The recent surge of high-throughput molecular data from biological settings generated from distinct biological and physiological systems and emphasis on translational research will be taught in the present course and is

## 8. \* Check the category most applicable to this course:

Traditional - Offered in Corresponding Departments at Universities Elsewhere

Relatively New - Now Being Widely Established

Not Yet Found in Many (or Any) Other Universities

## 9. Course Relationship to Program(s).

a. \* Is this course part of a proposed new program?  Yes  No

If YES, name the proposed new program:

b. \* Will this course be a new requirement <sup>s</sup> for ANY program?  Yes  No

If YES <sup>s</sup>, list affected programs:

## 10. Information to be Placed on Syllabus.

a. \* Is the course 400G or 500?  Yes  No

If YES, the *differentiation for undergraduate and graduate students must be included* in the information required in 10.b. You must include: (i) identification of add assignments by the graduate students; and/or (ii) establishment of different grading criteria in the course for graduate students. (See SR 3.1.4.)

b.  \* The syllabus, including course description, student learning outcomes, and grading policies (and 400G-/500-level grading differentiation if applicable, from 10 attached.

## Distance Learning Form

This form must accompany every submission of a new/change course form that requests distance learning delivery. This form may be required when changing a course already approved for DL fields are required!

**Introduction/Definition:** For the purposes of the Commission on Colleges Southern Association of Colleges and Schools accreditation review, *distance learning* is defined as a fo educational process in which the majority of the instruction (interaction between students and instructors and among students) in a course occurs when students and instructors the same place. Instruction may be synchronous or asynchronous. A distance learning (DL) course may employ correspondence study, or audio, video, or computer technologies

A number of specific requirements are listed for DL courses. The **department** proposing the change in delivery method is responsible for ensuring that the requirements are satisfied at the individual course level. It is the responsibility of the instructor to have read and understood the university-level assurances regarding an equivalent experience for students utilizing DL (available at <http://www.uky.edu/USC/New/forms.htm>).

Course Number and Prefix:	BMI 633	Date:	3/19/2014
Instructor Name:	Radha Nagarajan	Instructor Email:	rnagarajan@uky.edu
Check the method below that best reflects how the majority of the course content will be delivered.			
Internet/Web-based <input checked="" type="checkbox"/> Interactive Video <input type="checkbox"/> Hybrid <input type="checkbox"/>			

### Curriculum and Instruction

- How does this course provide for timely and appropriate interaction between students and faculty and among students? Does the course syllabus conform to University Syllabus Guidelines, specifically the Distance Learning Considerations?  
This course provides timely interaction between students and faculty through blackboard emailing, UK emails, Blackboard announcement, and discussion boards. In addition, AdobeConnect will be used to communicate with students.
- How do you ensure that the experience for a DL student is comparable to that of a classroom-based student's experience? Aspects to explore: textbooks, course goals, of student learning outcomes, etc.  
All aspects of the class materials and instruction including instructional course goals and assessment of student learning outcomes will be the same if the course is offered in the classroom based setting.
- How is the integrity of student work ensured? Please speak to aspects such as password-protected course portals, proctors for exams at interactive video sites; academic policy; etc.  
Blackboard is password protected and the instructor will make sure to handle personal student matters as cautiously as possible. Time-stamped materials will be used to make sure the integrity of the students work.
- Will offering this course via DL result in at least 25% or at least 50%\* (based on total credit hours required for completion) of a degree program being offered via any of as defined above?  
No  
Which percentage, and which program(s)?  
N/A  
  
\*As a general rule, if approval of a course for DL delivery results in 50% or more of a program being delivered through DL, the effective date of the course's DL delivery months from the date of approval.
- How are students taking the course via DL assured of equivalent access to student services, similar to that of a student taking the class in a traditional classroom setting?  
The instructor will maintain both an off line and an online office hour on a regular basis.

### Library and Learning Resources

- How do course requirements ensure that students make appropriate use of learning resources?  
The video clips that are carefully chosen to supplement course lecture slides will be provided for further discussions. Practical exercise driven assignments will be given to students to achieve learning goals to
- Please explain specifically how access is provided to laboratories, facilities, and equipment appropriate to the course or program.  
All the readings assigned will be available based on free access or otherwise university licensed-articles. Learning tools and databases assigned for practical exercises will be available on a publicly accessible database,

### Student Services

- How are students informed of procedures for resolving technical complaints? Does the syllabus list the entities available to offer technical help with the delivery and/or of the course, such as the Information Technology Customer Service Center (<http://www.uky.edu/UKIT/>)?  
Yes.
- Will the course be delivered via services available through the Distance Learning Program (DLP) and the Academic Technology Group (ATL)?  
 Yes  
 No  
  
If no, explain how students enrolled in DL courses are able to use the technology employed, as well as how students will be provided with assistance in using said technology.  
N/A
- Does the syllabus contain all the required components, below?  Yes
  - Instructor's *virtual* office hours, if any.
  - The technological requirements for the course.
  - Contact information for Distance Learning programs (<http://www.uky.edu/DistanceLearning>) and Information Technology Customer Service Center (<http://www.uky.edu/UKIT/Help/>; 859-218-HELP).
  - Procedure for resolving technical complaints.
  - Preferred method for reaching instructor, e.g. email, phone, text message.
  - Maximum timeframe for responding to student communications.
  - Language pertaining academic accommodations:

- "If you have a documented disability that requires academic accommodations in this course, please make your request to the University Disability Resource Center. The Center will require current disability documentation. When accommodations are approved, the Center will provide me with a Letter of Accommodation details the recommended accommodations. Contact the Disability Resource Center, Jake Karnes, Director at 859-257-2754 or [jkarnes@email.uky.edu](mailto:jkarnes@email.uky.edu)."

- Specific dates of face-to-face or synchronous class meetings, if any.
- Information on Distance Learning Library Services (<http://www.uky.edu/Libraries/DLLS>)
  - Carla Cantagallo, DL Librarian
  - Local phone number: 859 257-0500, ext. 2171; long-distance phone number: (800) 828-0439 (option #6)
  - Email: [dllservice@email.uky.edu](mailto:dllservice@email.uky.edu)
  - DL Interlibrary Loan Service: [http://www.uky.edu/Libraries/libpage.php?lweb\\_id=253&lweb\\_id=16](http://www.uky.edu/Libraries/libpage.php?lweb_id=253&lweb_id=16)

11. I, the instructor of record, have read and understood all of the university-level statements regarding DL.

Instructor Name:

Radhakrishnan Nagarajan

Abbreviations: DLP = Distance Learning Programs ATG = Academic Technology Group Customer Service Center = 859-218-HELP (<http://www.uky.edu/UKIT/Help>)

Revised 8/09

Courses are typically made effective for the semester following approval. No course will be made effective until all approvals are received.

The chair of the cross-listing department must sign off on the Signature Routing Log.

In general, undergraduate courses are developed on the principle that one semester-hour of credit represents one hour of classroom meeting per week for a semester, exclusive of any laboratory meeting. A meeting, generally, represents at least two hours per week for a semester for one credit hour. (from SR 5.2.1)

You must also submit the Distance Learning Form in order for the proposed course to be considered for DL delivery.

In order to change a program, a program change form must also be submitted.

Rev 8/09

Submit as New Proposal    Save Current Changes



**UNIVERSITY OF KENTUCKY  
COLLEGE OF PUBLIC HEALTH**

Last modified: 2/10/2014

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**Course Syllabus**  
**BMI 633: Introduction to Bioinformatics**  
**Fall 2014**

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**CLASS MEETINGS AND LOCATION:**  
**Multi-Disciplinary Science Building, MDS 221,**  
**Mondays & Wednesdays: 12:30 PM -1:45 PM, EST**

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**Contact information**

Instructor: Dr. Radha Nagarajan  
Associate Professor, Division of Biomedical Informatics  
230F MDS Building, 725 Rose Street

Telephone: 859-218-0109

E-mail: [rnagarajan@uky.edu](mailto:rnagarajan@uky.edu) (Preferred method of contact)

Office Hours: Tuesday: 11:00A to Noon (By appointment/email)

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**Course description**

This course is geared towards a multi-disciplinary audience with an interest on applying the principles of information sciences for obtaining insight into biological processes and systems. Topics covered will include sequence alignment, scoring matrices, microarray gene expression, next generation sequencing, knowledge discovery from high-throughput assays, systems biology and molecular diagnostics. Programming using open-source languages such as Perl, R and bioinformatics tools will be taught as a part of the course. Upon successful completion, students will have a strong foundation in bioinformatics and proficient in using bioinformatics approaches for investigating novel biological paradigms.

**Course rationale:**

Bioinformatics is the use of information science to understand complex biological processes and systems. The need for bioinformatics has increased over time attributed to the explosion of high-throughput biological assays, integration of multiple data sources, system-level abstractions of signaling mechanism and molecular diagnostics. Bioinformatics has routinely resulted in biological breakthroughs as it often leads to discovering undocumented associations and hypothesis generation. This course is also an essential ingredient of biomedical informatics.

**Course prerequisites**

Undergraduate level courses in Life Sciences (BIO 103 or equivalent), Computer Programming (CS 101 or equivalent) and Statistics (STA 200 or equivalent) is desirable. Appreciation for life sciences as well as information sciences with a desire to learn in a multidisciplinary environment.

## **Course objectives**

1. Introduce students from biological, statistical, clinical and information science backgrounds to Bioinformatics concepts and tools.
2. Implement the necessary approaches and analyze real biological data sets hands-on in open-source environment such as R and Perl.
3. Become proficient in the analysis and interpretation of high-throughput molecular assays.

## **Public Health Competencies for Statistics and Informatics**

- Apply basic informatics techniques with vital statistics and public health records in the description of public health characteristics and in public health research and evaluation.
- Appreciate the importance of working collaboratively with diverse communities and constituencies (e.g. researchers, practitioners, agencies and organizations).
- Discuss the influences of social, organizational and individual factors on the use of information technology by end users.
- Collaborate with communication and informatics specialists in the process of design, implementation, and evaluation of public health programs.
- Use information technology to access, evaluate, and interpret public health data.
- Use informatics methods and resources as strategic tools to promote public health.
- Use informatics and communication methods to advocate for community public health programs and policies.

## **College of Public Health Competency- adopted from MPH Cross-cutting competency, 2013**

- Describe the genetic, physiologic, and psychosocial factors that affect susceptibility to adverse health outcomes following exposure to environmental hazards.
- Use evidence based principles and scientific knowledge effectively when involved in evaluation and decision-making in public health.

## **Student learning outcomes:**

Upon successful completion of this course, students are expected to be familiar in the following areas:

1. Fundamental concepts in bioinformatics
2. Using open-source software environments and bioinformatics tools for investigating various experimental data sets.
3. Familiarity with high-throughput biological assays and their analysis.
4. Using bioinformatics and systems biology approaches for their own research.

## **Textbooks**

Given the interdisciplinary content of bioinformatics courses with audience from distinct background the course contents will be based on the lecture notes. Supplementary References will be provided as required.

## **Course requirements and learner evaluation**

Course grades will be based upon evaluation of the following activities:

- 50 points Five Assignments (10 points each)
- 40 points Final project
- 10 points Attendance and Participation

Points Grading scheme:

100-90=A  
89-80=B  
79-70=C  
0-69=E

### **Instructor expectations**

1. Attendance and active participation in the class and counts towards your grades.
2. Lectures will be taught in a manner so as to enable students to use what they have learned in the subsequent sections. Therefore, understanding earlier lectures and completing the related assignments is critical for meaningful progress.
3. As a part of the assignments please be prepared to present your work using power-point presentations and demonstration of the working computer codes.
4. You are encouraged to use spell check and grammar check prior to submitting your written work. The Writing Laboratory is available to anyone who may need assistance.
5. Independent and critical thinking is highly encouraged. Faithful reproduction of learning materials from any source including the lectures is strongly discouraged.

### **Academic honesty**

Academic honesty is highly valued at the University. You must always submit work that represents your original words or ideas. If any words or ideas used in a class assignment submission do not represent your original words or ideas, you must cite all relevant sources and make clear the extent to which such sources were used. Words or ideas that require citation include, but are not limited to, all hard copy or electronic publications, whether copyrighted or not, and all verbal or visual communication when the content of such communication clearly originates from an identifiable sources. Per university policy, students shall not plagiarize, cheat, or falsify or misuse academic records. Students are expected to adhere to University policy on cheating and plagiarism in all courses. The minimum penalty for a first offense is a zero on the assignment on which the offense occurred. If the offense is considered severe or the student has other academic offenses on their record, more serious penalties, up to suspension from the university, may be imposed. All incidents of cheating and plagiarism are taken very seriously at the University of Kentucky, and there are specific policies and procedures in place to prosecute them. See S.R. 6.3.0 (PDF) for the exact Senate Rules regarding academic offenses.

### **Accommodations**

If you have a documented disability that requires academic accommodations, please see me as soon as possible during scheduled office hours. In order to receive accommodations in this course, submit to me a Letter of Accommodation from the Disability Resource Center. If you have not already done so, please register with the Disability Resource Center for coordination of campus disability services available to students with disabilities. Contact Jake Karnes via email at [jkarnes@email.uky.edu](mailto:jkarnes@email.uky.edu) or by telephone 859-257-2754. You may also visit the DRC website for information on how to register for services as a student with a disability: <http://www.uky.edu/StudentAffairs/DisabilityResourceCenter/>

### **Religious Observances**

Students will be given the opportunity to make up work (typically, exams or assignments) when students notify their instructor that religious observances prevent the student from completing assignments according to deadlines stated in this syllabus. Students must notify the course

instructor at least two weeks prior to such an absence and propose how to make up the missed academic work.

### **Inclement weather**

The University of Kentucky has a detailed policy for decisions to close in inclement weather. This policy is described in detail at [http://www.uky.edu/PR/News/severe\\_weather.htm](http://www.uky.edu/PR/News/severe_weather.htm) or you can call (859) 257-1754.

### **Late work policy:**

Assignments that are turned in late will be marked one letter grade lower unless prior approval from the instructor has been obtained. It will be based on the time stamp provided by Blackboard. (NOTE: Assignments more than one week past the original due date will not be graded.)

### **Excused absences policy**

Attendance, excused absences and make-up opportunities for this course will conform to the course policies established by the Office of Academic Ombud Services as found at [www.uky.edu/Ombud/policies.php](http://www.uky.edu/Ombud/policies.php)

### **Other University Resources**

The UK Violence Intervention and Prevention (VIP) Center provides advocacy services to women survivors of violence in the UK community. The VIP Center can provide assistance in accessing and navigating services, resources and referrals both on and off campus. Services include: academic advocacy, medical advocacy, counseling, financial advocacy, referral advocacy, and other practical needs that a student may request. 106 Frazee Hall, 257-3574 or 257-3564. <http://www.uky.edu/StudentAffairs/VIPCenter/index.html#>

### Course schedule and topics (tentative)

Topics	Schedule	Reference Reading
Introduction What is Bioinformatics?	Week 1	<a href="http://www.ncbi.nlm.nih.gov/pubmed/11552348">http://www.ncbi.nlm.nih.gov/pubmed/11552348</a>
Essentials of Molecular Biology		Lodish, Molecular Cell Biology 6 <sup>th</sup> Edition
<b>Assignment 1 Due (10 points)</b>	<b>Week 2</b>	Presentation on <a href="http://www.ncbi.nlm.nih.gov/pubmed/11552348">http://www.ncbi.nlm.nih.gov/pubmed/11552348</a>
Introduction to Sequence Alignment	Week 3	Mount, D, Bioinformatics Sequence and Genome Analysis, Chapter 3
Local and Global Alignment		
Scoring Matrices, Heuristic Approaches, Sequence Databases		
<b>Assignment 2 Due (10 points)</b>	<b>Week 4</b>	<b>Presentation of global and local sequence alignment implementation in R</b>
Fundamentals of R Programming	Week 5	Introduction to R Manual, <a href="http://cran.r-project.org/doc/manuals/R-intro.html">http://cran.r-project.org/doc/manuals/R-intro.html</a>
High-throughput Assays: Microarrays	Week 6	Speed, T. Statistical Analysis of Microarray data, Chapman and Hall.
Gene Expression Analysis with Bioconductor		
Gene set enrichment using DAVID and NetAffx	Week 7	<a href="http://david.abcc.ncifcrf.gov/">http://david.abcc.ncifcrf.gov/</a> <a href="http://www.affymetrix.com/analysis/index.affx">http://www.affymetrix.com/analysis/index.affx</a>
<b>Assignment 3 Due (10 points)</b>	<b>Week 8</b>	<b>Presentation on Differential Microarray Gene Expression Analysis and critical evaluation of the findings</b>
High-throughput Assays: Next- Generation Sequencing	Week 9	Introduction to Next Generation Sequencing, Tutorial by Illumina  <a href="http://res.illumina.com/documents/products/illumina_sequencing_introduction.pdf">http://res.illumina.com/documents/products/illumina_sequencing_introduction.pdf</a>
<b>Assignment 4 Due (10 points)</b>	<b>Week 10</b>	<b>Presentation on Clustering and Enrichment Analysis of Microarray Data</b>
Systems Biology and Molecular	Week 11	Nagarajan, R, Scutari, M, Lebre, S. Bayesian

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Networks

Networks in R with Application to Systems  
Biology, Springer-Verlag.

Modeling and Analysis of  
Molecular Networks

Genome-wide Association  
Studies

Week 12

Lecture Notes

**Assignment 5 Due**

**Week 13**

**Molecular network modeling of single-cell  
expression profiles**

<http://www.sciencemag.org/content/308/5721/523>

Molecular Diagnostics and  
Personalized Medicine

Week 14

Buckingham, L. Molecular Diagnostics, FA Davis

Experimental Validation

Perl Programming

Week 15

Tisdall, J Beginning Perl for Bioinformatics,  
O'Reilly.

**Final Project  
(40 points)**

**Week 16**

**Write-Up, Presentation and Demonstration**

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**UNIVERSITY OF KENTUCKY  
COLLEGE OF PUBLIC HEALTH**

Last modified: 2/10/14

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**Course Syllabus**  
**BMI 633: Introduction to Bioinformatics**  
**Blackboard Course**  
**Fall 2014**

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**Contact information**

Instructor: Dr. Radha Nagarajan  
Associate Professor, Division of Biomedical Informatics  
230F MDS Building, 725 Rose Street

Telephone: 859-218-0109

E-mail: [rnagarajan@uky.edu](mailto:rnagarajan@uky.edu) (preferred method of contact)  
(maximum response time frame is 48 hours)

Office Hours (offline/online): Tuesdays: 11:00A to 12:00P (By appointment/email)

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- **Online course materials posting date and time:** Wednesdays by 11:59pm, EST
  - **Virtual Office/Online Class Schedules via AdobeConnect:**  
<https://connect.uky.edu/XXXXXX>
  - NO face-to-face meetings are assigned for this class.
  - Online presentation through AdobeConnect date and time is scheduled for Week 16.
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**Course description**

This course is geared towards a multi-disciplinary audience with an interest on applying the principles of information sciences for obtaining insight into biological processes and systems. Topics covered will include sequence alignment, scoring matrices, microarray gene expression, next generation sequencing, knowledge discovery from high-throughput assays, systems biology and molecular diagnostics. Programming using open-source languages such as Perl, R and bioinformatics tools will be taught as a part of the course. Upon successful completion, students will have a strong foundation in bioinformatics and proficient in using bioinformatics approaches for investigating novel biological paradigms.

**Course rationale:**

Bioinformatics is the use of information science to understand complex biological processes and systems. The need for bioinformatics has increased over time attributed to the explosion of high-throughput biological assays, integration of multiple data sources, system-level abstractions of signaling mechanism and molecular diagnostics. Bioinformatics has routinely resulted in biological breakthroughs as it often leads to discovering undocumented associations and hypothesis generation. This course is also an essential ingredient of biomedical informatics.

### **Course prerequisites**

Undergraduate level courses in Life Sciences (BIO 103 or equivalent), Computer Programming (CS 101 or equivalent) and Statistics (STA 200 or equivalent) is desirable. Appreciation for life sciences as well as information sciences with a desire to learn in a multidisciplinary environment.

### **Course objectives**

1. Introduce students from biological, statistical, clinical and information science backgrounds to Bioinformatics concepts and tools.
2. Implement the necessary approaches and analyze real biological data sets hands-on in open-source environment such as R and Perl.
3. Become proficient in the analysis and interpretation of high-throughput molecular assays.

### **Public Health Competencies for Statistics and Informatics**

- Apply basic informatics techniques with vital statistics and public health records in the description of public health characteristics and in public health research and evaluation.
- Appreciate the importance of working collaboratively with diverse communities and constituencies (e.g. researchers, practitioners, agencies and organizations).
- Discuss the influences of social, organizational and individual factors on the use of information technology by end users.
- Collaborate with communication and informatics specialists in the process of design, implementation, and evaluation of public health programs.
- Use information technology to access, evaluate, and interpret public health data.
- Use informatics methods and resources as strategic tools to promote public health.
- Use informatics and communication methods to advocate for community public health programs and policies.

### **College of Public Health Competency- adopted from MPH Cross-cutting competency, 2013**

- Describe the genetic, physiologic, and psychosocial factors that affect susceptibility to adverse health outcomes following exposure to environmental hazards.
- Use evidence based principles and scientific knowledge effectively when involved in evaluation and decision-making in public health.

### **Student learning outcomes:**

Upon successful completion of this course, students are expected to be familiar in the following areas:

1. Fundamental concepts in bioinformatics
2. Using open-source software environments and bioinformatics tools for investigating various experimental data sets.
3. Familiarity with high-throughput biological assays and their analysis.
4. Using bioinformatics and systems biology approaches for their own research.

### **Textbooks**

Given the interdisciplinary content of bioinformatics courses with audience from distinct background the course contents will be based on the lecture notes. Supplementary References will be provided as required.



## **Course requirements and learner evaluation**

Course grades will be based upon evaluation of the following activities:

- Five Assignments (10 points each, 50 points total)
- Final project (40 points)
- Attendance and Participation (10 points)

### **Grade Distribution:**

<i>Points</i>	<i>Letter grade</i>
100-90	A
89-80	B
79-70	C
0-69	E

### **Instructor expectations**

1. Lectures will be listed in a sequential manner. Understanding earlier lectures and completing the related assignments is critical as the latter lectures may be dependent on the earlier ones.
2. As a part of the assignments please be prepared to present your work using power-point presentations and demonstration of the working computer codes through AdobeConnect.
3. You are encouraged to use spell check and grammar check prior to submitting your written work. The Writing Laboratory is available to anyone who may need assistance.
4. Independent and critical thinking is highly encouraged. Faithful reproduction of learning materials from any source including the lectures is strongly discouraged.

### **Academic honesty**

Academic honesty is highly valued at the University. You must always submit work that represents your original words or ideas. If any words or ideas used in a class assignment submission do not represent your original words or ideas, you must cite all relevant sources and make clear the extent to which such sources were used. Words or ideas that require citation include, but are not limited to, all hard copy or electronic publications, whether copyrighted or not, and all verbal or visual communication when the content of such communication clearly originates from an identifiable sources. Per university policy, students shall not plagiarize, cheat, or falsify or misuse academic records. Students are expected to adhere to University policy on cheating and plagiarism in all courses. The minimum penalty for a first offense is a zero on the assignment on which the offense occurred. If the offense is considered severe or the student has other academic offenses on their record, more serious penalties, up to suspension from the university, may be imposed. All incidents of cheating and plagiarism are taken very seriously at the University of Kentucky, and there are specific policies and procedures in place to prosecute them. See S.R. 6.3.0 (PDF) for the exact Senate Rules regarding academic offenses.

### **Accommodations**

If you have a documented disability that requires academic accommodations, please see me as soon as possible during scheduled office hours. In order to receive accommodations in this course, submit to me a Letter of Accommodation from the Disability Resource Center. If you have not already done so, please register with the Disability Resource Center for coordination of campus disability services available to students with disabilities. Contact Jake Karnes via email

at [jkarnes@email.uky.edu](mailto:jkarnes@email.uky.edu) or by telephone 859-257-2754. You may also visit the DRC website for information on how to register for services as a student with a disability: <http://www.uky.edu/StudentAffairs/DisabilityResourceCenter/>

### **Religious Observances**

Students will be given the opportunity to make up work (typically, exams or assignments) when students notify their instructor that religious observances prevent the student from completing assignments according to deadlines stated in this syllabus. Students must notify the course instructor at least two weeks prior to such an absence and propose how to make up the missed academic work.

### **Inclement weather**

The University of Kentucky has a detailed policy for decisions to close in inclement weather. This policy is described in detail at [http://www.uky.edu/PR/News/severe\\_weather.htm](http://www.uky.edu/PR/News/severe_weather.htm) or you can call (859) 257-1754.

### **Late work policy:**

Assignments that are turned in late will be marked one letter grade lower unless prior approval from the instructor has been obtained. It will be based on the time stamp provided by Blackboard. (NOTE: Assignments more than one week past the original due date will not be graded.)

### **Excused absences policy**

Attendance, excused absences and make-up opportunities for this course will conform to the course policies established by the Office of Academic Ombud Services as found at [www.uky.edu/Ombud/policies.php](http://www.uky.edu/Ombud/policies.php)

### **Other University Resources**

The UK Violence Intervention and Prevention (VIP) Center provides advocacy services to women survivors of violence in the UK community. The VIP Center can provide assistance in accessing and navigating services, resources and referrals both on and off campus. Services include: academic advocacy, medical advocacy, counseling, financial advocacy, referral advocacy, and other practical needs that a student may request. 106 Frazee Hall, 257-3574 or 257-3564. <http://www.uky.edu/StudentAffairs/VIPCenter/index.html#>

### **Technical Requirements** (Adopted from Distance Learning Recommendation):

"In order to have a successful educational experience in distance learning courses, there are minimum technology requirements that should be met. The University of Kentucky strongly recommends that each student purchase a personal computer. To review minimum recommendations and guidelines for your computer click here.

University of Kentucky distance learning students are also encouraged to acquire the following hardware, software, and Internet connection to ensure that all systems used by distance learning courses will function properly."

Go to the link at: <http://www.uky.edu/DistanceLearning/current/technology/techReqs.html> to test your network speed and other necessarily technology requirements for this class.

### **Information on Distance Learning Library Services**

- Available at: <http://libraries.uky.edu/dlls>

- Carla Cantagallo, DL Librarian, (859) 218-1240
- Email: [dllservice@email.uky.edu](mailto:dllservice@email.uky.edu)
- DL Interlibrary Loan Service: [http://libraries.uky.edu/page.php?lweb\\_id=253](http://libraries.uky.edu/page.php?lweb_id=253)

### **Contact information for:**

TASC <http://www.uky.edu/ukit/atg/tasc>  
 Information Technology Customer Service Center <http://www.uky.edu/ukit/>

### **Technical Issues**

Students should contact the instructor (via email) and the UKIT help desk in case they are unable to access the materials (<http://www.uky.edu/UKIT>, 859-218-HELP) so that issues can be resolved in a timely fashion and homeworks can be submitted on time.

### **Technology Requirements**

Since this is a distance-learning course, students are required to have stable access to a computer and hence encourage students to own a personal computer (laptop/desktop is okay but tablets are not sufficient) according to these requirements:

<http://www.uky.edu/ukit/hardwareguide>

Furthermore, to fully participate in the distance learning experience students are also required to install the following software and acquire useful hardware:

<http://www.uky.edu/DistanceLearning/current/technology/techReqs.html>

### **Course schedule and topics (tentative)**

Topics	Schedule	Reference Reading
Introduction What is Bioinformatics?	Week 1	<a href="http://www.ncbi.nlm.nih.gov/pubmed/11552348">http://www.ncbi.nlm.nih.gov/pubmed/11552348</a>
Essentials of Molecular Biology		Lodish, Molecular Cell Biology 6 <sup>th</sup> Edition
<b>Assignment 1 Due (10 points)</b>	<b>Week 2</b>	Presentation on <a href="http://www.ncbi.nlm.nih.gov/pubmed/11552348">http://www.ncbi.nlm.nih.gov/pubmed/11552348</a>
Introduction to Sequence Alignment	Week 3	Mount, D, Bioinformatics Sequence and Genome Analysis, Chapter 3

Local and Global Alignment		
Scoring Matrices, Heuristic Approaches, Sequence Databases		
<b>Assignment 2 Due (10 points)</b>	<b>Week 4</b>	<b>Presentation of global and local sequence alignment implementation in R</b>
Fundamentals of R Programming	Week 5	Introduction to R Manual, <a href="http://cran.r-project.org/doc/manuals/R-intro.html">http://cran.r-project.org/doc/manuals/R-intro.html</a>
High-throughput Assays: Microarrays	Week 6	Speed, T. Statistical Analysis of Microarray data, Chapman and Hall.
Gene Expression Analysis with Bioconductor		
Gene set enrichment using DAVID and NetAffx	Week 7	<a href="http://david.abcc.ncifcrf.gov/">http://david.abcc.ncifcrf.gov/</a> <a href="http://www.affymetrix.com/analysis/index.affx">http://www.affymetrix.com/analysis/index.affx</a>
<b>Assignment 3 Due (10 points)</b>	<b>Week 8</b>	<b>Presentation on Differential Microarray Gene Expression Analysis and critical evaluation of the findings</b>
High-throughput Assays: Next-Generation Sequencing	Week 9	Introduction to Next Generation Sequencing, Tutorial by Illumina  <a href="http://res.illumina.com/documents/products/illumina_sequencing_introduction.pdf">http://res.illumina.com/documents/products/illumina_sequencing_introduction.pdf</a>
<b>Assignment 4 Due (10 points)</b>	<b>Week 10</b>	<b>Presentation on Clustering and Enrichment Analysis of Microarray Data</b>
Systems Biology and Molecular Networks	Week 11	Nagarajan, R, Scutari, M, Lebre, S. Bayesian Networks in R with Application to Systems Biology, Springer-Verlag.
Modeling and Analysis of Molecular Networks		
Genome-wide Association Studies	Week 12	Lecture Notes
<b>Assignment 5 Due</b>	<b>Week 13</b>	<b>Molecular network modeling of single-cell expression profiles</b> <a href="http://www.sciencemaq.org/content/308/5721/523">http://www.sciencemaq.org/content/308/5721/523</a>
Molecular Diagnostics and	Week 14	Buckingham, L. Molecular Diagnostics, FA Davis

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Personalized Medicine

Experimental Validation

Perl Programming

Week 15

Tisdall, J Beginning Perl for Bioinformatics,  
O'Reilly.

**Final Project  
(40 points)**

**Week 16**

**Write-Up, Presentation and Demonstration**

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Center for Clinical and  
Translational Science (CCTS)

Center for Clinical and  
Translational Science  
UK Chandler Medical Center  
Pavilion H  
800 Rose Street, Room C300  
Lexington, KY 40536-0293  
www.ccts.uky.edu

May 29, 2014

Stephen W. Wyatt, DMD, MPH  
Dean  
College of Public Health  
111 Washington Avenue, Room 112  
CAMPUS 0003

Dear Dean Wyatt:

The NIH CTSA program places great value on biomedical informatics research and training programs. For CTSA's, from a training perspective, informatics, bioinformatics and clinical/informatics content and courses for professional and academic doctoral, as well as professional and academic masters students are major priorities. Every aspect of the health sciences, from basic research, to clinical care to community based outcomes studies, will continue to be dependent on the analysis of data and the translation of data into information, and thus it is critically important that we train the next generation of clinicians and researchers in informatics. The UK Center for Clinical and Translational Science (CCTS), as part of the NIH CTSA network, has been building courses for students on our campus. The proposed courses are part of the CCTS plan to build toward an academic degree offering in biomedical informatics. In addition, the courses will also be available to professional doctoral students in Medicine and Pharmacy, and will be available for inclusion in certificate programs on our campus. These courses have potential beyond our campus; Medical schools at Marshall University, East Tennessee State University and the University of Pikeville are exploring arrangements to access these courses for their students.

As the CCTS prepares for its next grant submission in 2015-2016, these courses are an important and strategic priority.

Sincerely,

A handwritten signature in black ink, appearing to read 'Phillip A. Kern'.

Phillip A. Kern, M.D.  
Professor of Medicine, Division of Endocrinology  
Director, Center for Clinical and Translational Sciences  
Associate Provost for Clinical and Translational Science  
Director, Barnstable Brown Diabetes and Obesity Center



June 6, 2014

Stephen W. Wyatt, DMD, MPH  
Dean  
College of Public Health  
111 Washington Avenue, Room 112  
CAMPUS 0003

Dear Dean Wyatt:

As you know, the PhD program in Epidemiology and Biostatistics is intended to be an integrative doctoral program which prepares future researchers who will have substantial quantitative preparation in the unique domains of these two disciplines. The essentially strong cross-training and mentoring nature of the program is intended to develop independent researchers skilled in designing and conducting studies, as well as analyzing and interpreting the results from an increasing variety of study designs.

As the current Chair of Academic Affairs, I recently reviewed the large complement of courses in bioinformatics, clinical informatics, information retrieval, and natural language processes that have been developed by our faculty in the Division of Bioinformatics. Many of these courses may be suitable electives for our doctoral students. As you are aware, there has been an intense demand for scientifically trained (subject matter) data analysts who can address the issues in conducting studies which include large amounts of complex data.

For epidemiologists and biostatisticians working in human genome epidemiology, statistical genetics, and related disciplines, the field will require a better understanding of the management and retrieval of information from these large datasets. Training in biomedical informatics will be appealing to some of our PhD students in Epidemiology and Biostatistics and will be encouraged by many of our program faculty.

Sincerely,

A handwritten signature in black ink that reads "STEVE BROWNING". The signature is written in a cursive style with a horizontal line underlining the name.

Steven R. Browning, PhD  
Associate Professor, Director of Graduate Studies for the PhD  
Department of Epidemiology  
111 Washington Ave, Suite 209B  
Lexington, Kentucky 40536-0003  
(859) 218-2235  
Phone: (859) 218-2235  
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[www.mc.uky.edu/PublicHealth](http://www.mc.uky.edu/PublicHealth)

June 6, 2014

Stephen W. Wyatt, DMD, MPH  
Dean  
College of Public Health  
111 Washington Avenue, Room 112  
CAMPUS 0003

Dear Dean Wyatt:

I am writing to offer my enthusiastic support for the new biomedical informatics courses that are being proposed to the Graduate Council. As you know, the Master of Science program in Clinical Research Design is intended to prepare practicing health care professionals and students pursuing a terminal degree (MD, PharmD, etc.) to conduct population based research. The program is targeted to students who wish to enhance their translational research skills and increase their knowledge of population-based health and clinical trials. MDs interested in an academic appointment will find that this degree program will make them competitive for the best positions, where research skills are becoming the norm. Of particular demand for medical researchers are effective uses of biomedical data, information, and knowledge for scientific inquiry, problem solving and decision-making motivated by efforts to improve human health.

Our MS program is designed to accommodate graduates of the Certificate in Clinical Research Skills offered in conjunction with the Center for Clinical and Translational Sciences, which strongly emphasizes and relies on biomedical informatics. The addition of these courses to the list of electives that Clinical Research Design students can choose will be extremely attractive to current students, and may perhaps entice prospective students to pursue the Graduate Certificate or degree program. The faculty proposing and teaching these courses are great partners in education and research and I look forward to strengthening existing ties through implementation of these courses. For these reasons, as Director of Graduate Studies for the MS program in Clinical Research Design, I fully support these new course proposals.

Sincerely,

David M. Mannino, M.D.  
Professor and Chair  
Department of Preventive Medicine and Environmental Health  
Director of Graduate Studies, Masters of Science in Clinical Research Design  
University of Kentucky College of Public Health

Department of Pulmonary, Critical Care, and Sleep Medicine  
University of Kentucky College of Medicine



**Perkins, Andrea L**

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**To:** Mirosław Truszczyński  
**Subject:** RE: Support for BMI courses

**From:** [mirektruszczyński@gmail.com](mailto:mirektruszczyński@gmail.com) [mailto:[mirektruszczyński@gmail.com](mailto:mirektruszczyński@gmail.com)] **On Behalf Of** Mirosław Truszczyński  
**Sent:** Wednesday, July 16, 2014 9:46 AM  
**To:** Perkins, Andrea L  
**Cc:** Nagarajan, Radha; KIM, SUJIN; Wray, Johanna (JoJo)  
**Subject:** Re: Support for BMI courses

I reviewed the proposals for the new biomedical courses BMI 633, 730-735. I find them useful to candidates for the Informatics Certificate, pursued typically by 2-4 students per year.

I support their approval.

Mirek Truszczyński  
Director, Informatics Certificate