The Mission of IUPUI is to provide for its constituents excellence in
• Teaching and Learning
• Research, Scholarship, and Creative Activity
• Civic Engagement
With each of these core activities characterized by
• Collaboration within and across disciplines and with the community
• A commitment to ensuring diversity, and
• Pursuit of best practices
IUPUI’s mission is derived from and aligned with the principal components – Communities of Learning, Responsibilities of Excellence, Accountability and Best Practices – of Indiana University’s Strategic Directions Charter.

Statement of Values
IUPUI values the commitment of students to learning; of faculty to the highest standards of teaching, scholarship, and service; and of staff to the highest standards of service. IUPUI recognizes students as partners in learning. IUPUI values the opportunities afforded by its location in Indiana’s capital city and is committed to serving the needs of its community. Thus, IUPUI students, faculty, and staff are involved in the community; both to provide educational programs and patient care and to apply learning to community needs through service. As a leader in fostering collaborative relationships, IUPUI values collegiality, cooperation, creativity, innovation, and entrepreneurship as well as honesty, integrity, and support for open inquiry and dissemination of findings. IUPUI is committed to the personal and professional development of its students, faculty, and staff and to continuous improvement of its programs and services.

Electronic course site:
– oncourse.iu.edu
– distribution of homework assignments and class notes
– should be accessible if you have IU ID and registered for the course

Course website:  http://www.iupui.edu/~jangalab/cstudents.php
– Syllabus, outline of lectures, course calendar and suggested reading
– Final projects and presentation schedules
Lectures location & time:
– IT 271, Tuesday 6:00pm-8:40pm
– May have some guest lectures, not necessarily in the same room and time

Textbook:
– class notes will be distributed via course website and the following books are recommended (for course assignments, exercises and projects)

Reading (referred books):

Student Learning Outcomes:

<table>
<thead>
<tr>
<th>Upon completion of this course, students will</th>
<th>RBT</th>
<th>PGPL</th>
<th>Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Be introduced to the basics of molecular biology and need of programming in biology.</td>
<td>4</td>
<td>2</td>
<td>L1</td>
</tr>
<tr>
<td>2. Learn basics of operating systems and running shell commands to perform routine tasks.</td>
<td>3</td>
<td>1</td>
<td>L2 A1</td>
</tr>
<tr>
<td>3. Learn Perl Basics and able to script for analyzing simple to complex biological data sets with advanced integrated aspect of unix and perl.</td>
<td>4</td>
<td>1</td>
<td>L3 L4 L5 A2</td>
</tr>
<tr>
<td>4. Learn R programming basics, analyze read, edit and write a file in R, perform statistical testing and generate graphics. Student will be able to write R scripts for analyzing biological data sets.</td>
<td>4</td>
<td>2</td>
<td>L6 L7 A3 A4</td>
</tr>
<tr>
<td>5. Learn writing html code and developing code to connect databases with PERL/PHP.</td>
<td>5</td>
<td>2</td>
<td>L8</td>
</tr>
<tr>
<td>6. Understand dealing with data and database management systems. Student will also learn different major public databases in biological domain.</td>
<td>4</td>
<td>2</td>
<td>L9</td>
</tr>
<tr>
<td>7. Learn various bioinformatics applications- command line and interface</td>
<td>5</td>
<td>1</td>
<td>L10</td>
</tr>
<tr>
<td>8. Write a report and give an oral presentation grounded in an appropriate review of the literature.</td>
<td>6</td>
<td>3</td>
<td>F P</td>
</tr>
</tbody>
</table>

*RBT: Revised Bloom’s Taxonomy*
<table>
<thead>
<tr>
<th>Week (date)</th>
<th>Topics</th>
<th>Reading</th>
<th>Assignments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Week 1 (Tue, Aug 21st)</td>
<td>L1-Introduction to the course: Outline, syllabus, evaluation procedures and primer on molecular biology</td>
<td>Lecture slides available through oncourse</td>
<td></td>
</tr>
<tr>
<td>Week 2 (Tue, Aug 28th)</td>
<td>L2-Working with Computer/Workstation: Basics of operating systems and running shell commands to perform routine tasks. Forming groups for course projects.</td>
<td>Lecture slides available through oncourse</td>
<td>A1: Unix command line; file downloading, handling and appending</td>
</tr>
<tr>
<td>Week 3 (Tue, Sep 4th)</td>
<td>L3-Working with Perl - Perl Basics: This Lecture will be given by IT training group.</td>
<td>Lecture slides available through oncourse</td>
<td></td>
</tr>
<tr>
<td>Week 4 (Tue, Sep 11th)</td>
<td>L4-Working with Perl - Perl Basics: Developing simple to complex perl scripts for analyzing biological data sets.</td>
<td>Lecture slides available through oncourse</td>
<td>A2: Given a fastq sequence for provided genome, count frequency of each codon/dinucleotide, and translate to protein sequence.</td>
</tr>
<tr>
<td>Week 5 (Tue, Sep 18th)</td>
<td>L5-Working with Computer/Workstation/Perl: Advanced aspects of unix and perl</td>
<td>Lecture slides available through oncourse</td>
<td></td>
</tr>
<tr>
<td>Week 6 (Tue, Sep 25th)</td>
<td>L6-Working with R: Developing simple R scripts for analyzing biological data sets.</td>
<td>Lecture slides available through oncourse</td>
<td>A3: Read, edit and write a file in R. perform statistical testing and generate graphics.</td>
</tr>
<tr>
<td>Week 7 (Tue, Oct 2nd)</td>
<td>L7-Working with R: Developing simple R scripts for analyzing biological data sets.</td>
<td>Lecture slides available through oncourse</td>
<td>A4: Downloading, parsing and analysis of E.coli genome and graphical representation in R</td>
</tr>
<tr>
<td>Week 8 (Tue, Oct 9th)</td>
<td>L8-Working with Web: Writing html code and developing code to connect databases with</td>
<td>Lecture slides available through</td>
<td></td>
</tr>
<tr>
<td>Week 9 (Oct 12-16th)</td>
<td>PERL/PHP.</td>
<td>oncourse</td>
<td></td>
</tr>
<tr>
<td>----------------------</td>
<td>-----------</td>
<td>----------</td>
<td></td>
</tr>
<tr>
<td>Spring Break</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Week 10 (Tue, Oct 23rd) | L9-Working with Data: Introduction to database systems and different major public databases in biological domain. This Lecture will be given by IT training group. | Lecture slides available through oncourse |

| Week 11-14 (Oct 30th-Nov 20) | Presentation of the papers and description of the project work | |
| Week 14 (Nov 21-25) | Thanksgiving Break | |
| Week 15 (Tue, Nov 27th) | Presentation of the papers and description of the project work | |

**NOTE: DUE DATE FOR PROJECT REPORT SUBMISSIONS**

<table>
<thead>
<tr>
<th>Week 16 (Tue, Dec 4th)</th>
<th>L10-Working with Applications: Bioinformatics applications-command line and interface</th>
<th>Lecture slides available through oncourse</th>
</tr>
</thead>
</table>

**Course Description and Outcomes:**

In this course, we will cover the basics of programming as they are relevant to understanding and analyzing biological datasets. This will be achieved by giving a biology background to motivate a computational need/task. At the end of the course, you should be able to describe solutions (preferably elegant) to address a wide range of basic biological and biomedical problems.

The course is aimed at giving a good foundation in UNIX based administration, PERL programming, MySQL database management, R statistical analysis and application development in omics settings using these programming languages/tools.

The instructor will give introductions to each of these programming languages and commonly used applications in bioinformatics/systems biology in the first 10 weeks. Then the students will be asked to present recent articles published in the last 4 years (each student has to present couple of papers), present a project work on a particular theme/problem and submission of the project report.

**Core Competencies:** Some background of biology is expected and having knowledge of the logic of programming is advantageous.

**Software used:** Unix operating system, Perl, R and SQL (Either Oracle and Mysql)
Grading Scale: (Tentative)

<table>
<thead>
<tr>
<th>Grade</th>
<th>Range</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A+</td>
<td>97 – 100</td>
<td>Outstanding achievement, given at the instructor's discretion</td>
</tr>
<tr>
<td>A</td>
<td>93 – 100</td>
<td>Excellent achievement</td>
</tr>
<tr>
<td>A−</td>
<td>90 – 92.99</td>
<td>Very good performance and quality of work</td>
</tr>
<tr>
<td>B+</td>
<td>87 – 089.99</td>
<td>Good performance and quality of work</td>
</tr>
<tr>
<td>B</td>
<td>83 – 086.99</td>
<td>Modestly acceptable performance and quality of work</td>
</tr>
<tr>
<td>B−</td>
<td>80 – 082.99</td>
<td>Marginal acceptable performance and quality of work</td>
</tr>
<tr>
<td>C+</td>
<td>77 – 079.99</td>
<td>Unacceptable work (Core course must be repeated for credit)</td>
</tr>
<tr>
<td>C</td>
<td>73 – 076.99</td>
<td>Unacceptable work (Core course must be repeated for credit)</td>
</tr>
<tr>
<td>C−</td>
<td>70 – 072.99</td>
<td>Unacceptable work (Course must be repeated for credit)</td>
</tr>
<tr>
<td>D+</td>
<td>67 – 069.99</td>
<td>Unacceptable work (Course must be repeated for credit)</td>
</tr>
<tr>
<td>D</td>
<td>63 – 066.99</td>
<td>Unacceptable work (Course must be repeated for credit)</td>
</tr>
<tr>
<td>D−</td>
<td>60 – 062.99</td>
<td>Unacceptable work (Course must be repeated for credit)</td>
</tr>
<tr>
<td>F</td>
<td>Below 60</td>
<td>Unacceptable work (Course must be repeated for credit)</td>
</tr>
</tbody>
</table>

No credits toward major, minor, or certificate requirements are granted for a grade below B−.

Course Evaluation

Homework/Assignments (40%)
- A total of four programming assignments (40%)
- At least one assignment each on using Perl, R and MySQL (available from the course website)
- Strictly no copying of code from others and all the code should be functional to be awarded any grade.

Mid-term project evaluation (20%)
- A project on developing a pipeline for predicting function or phenotype by integrating different sources of functional associations in a model organism of choice (see on course website)
- The developed system should be submitted as a short report demonstrating its functionality and the conclusions derived from it for the chosen dataset.

Note: There will be no written exam in this course and most of the evaluation is based on your programming assignments and project work.

Final project (40%)
- Will be evaluated for 40% of the total points
- Will comprise of a project for which you can work in groups of up to 2 students
- Involves reading a series of papers, tackling a research problem, presenting the read papers, demonstrating the project developed based on the papers in the class and write-up of a short report on the project.
- Presentation of the project would be towards the end of the semester and will be evaluated as a group.
–Paper presentation would weigh 20% and project demonstration/report would be for 20%.
–Each group will present a different set of papers and project to work on.
–Any questions regarding the projects should be directed to jangalab@iupui.edu

COURSE EXPECTATIONS, GUIDELINES, AND POLICIES

Attendance:
A basic requirement of this course is that you will participate in all class meetings, whether online or face-to-face, and conscientiously complete all required course activities and assignments. Class attendance is required for classroom-based courses. It entails being present and attentive for the entire class period. Attendance shall be taken in every class. If you do not sign the attendance sheet while in class, you shall be marked absent. Signing the attendance sheet for another student is prohibited. The instructor is required to submit to the Registrar a record of student attendance, and action shall be taken if the record conveys a trend of absenteeism.

Only the following are acceptable excuses for absences: death in the immediate family (e.g. mother, father, spouse, child, or sibling), hospitalization or serious illness; jury duty; court ordered summons; religious holiday; university/school coordinated athletic or scholastic activities; an unanticipated event that would cause attendance to result in substantial hardship to one’s self or immediate family. Absences must be explained with the submission of appropriate documentation to the satisfaction of the instructor, who will decide whether missed work may be made up. Absences that do not satisfy the above criteria are considered unexcused. To protect your privacy, doctor’s excuses should exclude the nature of the condition and focus instead on how the condition impacts your attendance and academic performance.

Missing class reduces your grade through the following grade reduction policy: You are allowed two excused or unexcused absences. Each additional absence, unless excused, results in a 5% reduction in your final course grade. More than four absences result in an F in the course. Missing class may also reduce your grade by eliminating opportunities for class participation. For all absences, the student is responsible for all covered materials and assignments.

Incomplete:
The instructor may assign an Incomplete (I) grade only if at least 75% of the required coursework has been completed at passing quality and holding you to previously established time limits would result in unjust hardship to you. All unfinished work must be completed by the date set by the instructor. Left unchanged, an Incomplete automatically becomes an F after one year. [http://registrar.iupui.edu/incomp.html](http://registrar.iupui.edu/incomp.html)

Deliverables:
You are responsible for completing each deliverable (e.g., assignment, quiz) by its deadline and submitting it by the specified method. Deadlines are outlined in the syllabus or in supplementary documents accessible through OnCourse. Should you miss a class, you are still responsible for completing the deliverable and for finding out what was covered in class, including any new or modified deliverable. In fairness to the instructor and students who completed their work on time, a grade on a deliverable shall be reduced
10%, if it is submitted late and a further 10% for each 24-hour period it is submitted after the deadline.

CODE OF CONDUCT
All students should aspire to the highest standards of academic integrity. Using another student’s work on an assignment, cheating on a test, not quoting or citing references correctly, or any other form of dishonesty or plagiarism shall result in a grade of zero on the item and possibly an F in the course. Incidences of academic misconduct shall be referred to the Department Chair and repeated violations shall result in dismissal from the program.

All students are responsible for reading, understanding, and applying the Code of Student Rights, Responsibilities and Conduct and in particular the section on academic misconduct. Refer to The Code > Responsibilities > Academic Misconduct at http://www.indiana.edu/~code/. All students must also successfully complete the Indiana University Department of Education “How to Recognize Plagiarism” Tutorial and Test. https://www.indiana.edu/~istd You must document the difference between your writing and that of others. Use quotation marks in addition to a citation, page number, and reference whenever writing someone else’s words (e.g., following the Publication Manual of the American Psychological Association). To detect plagiarism instructors apply a range of methods, including Turnitin.com. http://www.ulib.iupui.edu/libinfo/turnitin

Academic Misconduct:
1. Cheating: Cheating is considered to be an attempt to use or provide unauthorized assistance, materials, information, or study aids in any form and in any academic exercise or environment.
   a. A student must not use external assistance on any “in-class” or “take-home” examination, unless the instructor specifically has authorized external assistance. This prohibition includes, but is not limited to, the use of tutors, books, notes, calculators, computers, and wireless communication devices.
   b. A student must not use another person as a substitute in the taking of an examination or quiz, nor allow other persons to conduct research or to prepare work, without advanced authorization from the instructor to whom the work is being submitted.
   c. A student must not use materials from a commercial term paper company, files of papers prepared by other persons, or submit documents found on the Internet.
   d. A student must not collaborate with other persons on a particular project and submit a copy of a written report that is represented explicitly or implicitly as the student’s individual work.
   e. A student must not use any unauthorized assistance in a laboratory, at a computer terminal, or on fieldwork.
   f. A student must not steal examinations or other course materials, including but not limited to, physical copies and photographic or electronic images.
g. A student must not submit substantial portions of the same academic work for credit or honors more than once without permission of the instructor or program to whom the work is being submitted.

h. A student must not, without authorization, alter a grade or score in any way, nor alter answers on a returned exam or assignment for credit.

2. **Fabrication:** A student must not falsify or invent any information or data in an academic exercise including, but not limited to, records or reports, laboratory results, and citation to the sources of information.

3. **Plagiarism:** Plagiarism is defined as presenting someone else’s work, including the work of other students, as one’s own. Any ideas or materials taken from another source for either written or oral use must be fully acknowledged, unless the information is common knowledge. What is considered “common knowledge” may differ from course to course.
   a. A student must not adopt or reproduce ideas, opinions, theories, formulas, graphics, or pictures of another person without acknowledgment.
   b. A student must give credit to the originality of others and acknowledge indebtedness whenever:
      1. directly quoting another person’s actual words, whether oral or written;
      2. using another person’s ideas, opinions, or theories;
      3. paraphrasing the words, ideas, opinions, or theories of others, whether oral or written;
      4. borrowing facts, statistics, or illustrative material; or
      5. offering materials assembled or collected by others in the form of projects or collections without acknowledgment

4. **Interference:** A student must not steal, change, destroy, or impede another student’s work, nor should the student unjustly attempt, through a bribe, a promise of favors or threats, to affect any student’s grade or the evaluation of academic performance. Impeding another student’s work includes, but is not limited to, the theft, defacement, or mutilation of resources so as to deprive others of the information they contain.

5. **Violation of Course Rules:** A student must not violate course rules established by a department, the course syllabus, verbal or written instructions, or the course materials that are rationally related to the content of the course or to the enhancement of the learning process in the course.

6. **Facilitating Academic Dishonesty:** A student must not intentionally or knowingly help or attempt to help another student to commit an act of academic misconduct, nor allow another student to use his or her work or resources to commit an act of misconduct.

**OTHER POLICIES**

1. **Right to revise:** The instructor reserves the right to make changes to this syllabus as necessary and, in such an event, will notify students of the changes immediately.

2. **IUPUI course policies:** A number of campus policies governing IUPUI
courses may be found at the following link: http://registrar.iupui.edu/course_policies.html

3. **Classroom civility:** To maintain an effective and inclusive learning environment, it is important to be an attentive and respectful participant in lectures, discussions, group work, and other classroom exercises. Thus, unnecessary disruptions should be avoided, such as ringing cell phones, engagement in private conversations and other unrelated activities. Cell phones, media players, or any noisy devices should be turned off during a class. Texting, surfing the Internet, and posting to Facebook or Twitter during class are generally not permitted. Laptop use may be permitted if it is used for taking notes or conducting class activities. Students should check with the instructor about permissible devices in class. IUPUI nurtures and promotes "a campus climate that seeks, values, and cultivates diversity in all of its forms and that provides conditions necessary for all campus community members to feel welcomed, supported, included, and valued" (IUPUI Strategic Initiative 9). IUPUI prohibits “discrimination against anyone for reasons of race, color, religion, national origin, sex, sexual orientation, marital status, age, disability, or [veteran] status” (Office of Equal Opportunity). Profanity or derogatory comments about the instructor, fellow students, invited speakers or other classroom visitors, or any members of the campus community shall not be tolerated. A violation of this rule shall result in a warning and, if the offense continues, possible disciplinary action.

4. **Bringing children to class:** To ensure an effective learning environment, children are not permitted to attend class with their parents, guardians, or childcare providers.

5. **Course Evaluations:** Course evaluations provide vital information for improving the quality of courses and programs. Students are urged to complete one course and instructor evaluation for each section in which they are enrolled at the School of Informatics and Computing with the following three exceptions: (a) The student has withdrawn from the course; (b) fewer than five students are enrolled in the section (in which case anonymity is impossible); and (c) the section is a laboratory that must be taken with a course having a different section number. Course evaluations are completed at https://soic.iupui.edu/app/course-eval/. Course evaluations are anonymous, which means that no one can view the name of the student completing the evaluation. In addition, no one can view the evaluation itself until after the instructor has submitted the final grades for the course. In small sections, demographic information should be left blank, if it could be used to identify the student.

6. **Communication:** For classroom-based courses, instructor or teaching assistant should respond to emails by the end of the next class or, for online courses, within two Indiana University working days, which excludes weekends and holidays. The instructor should provide weekly office hours or accept appointments for face-to-face, telephone, or teleconferenced meetings, and announce periods of extended absence in advance.
7. **Email:** Indiana University uses your IU email account as an official means of communication, and students should check it daily for pertinent information. Although you may have your IU email forwarded to an outside email account, please email faculty and staff from your IU email account.

8. **Disabilities Policy:** In compliance with the Americans with Disabilities Act (ADA), all qualified students enrolled in this course are entitled to reasonable accommodations. Please notify the instructor during the first week of class of accommodations needed for the course. Students requiring accommodations because of a disability must register with Adaptive Educational Services (AES) and complete the appropriate AES-issued before receiving accommodations. The AES office is located at UC 100, Taylor Hall (Email: aes@iupui.edu, Tel. 317 274-3241). Visit [http://aes.iupui.edu](http://aes.iupui.edu) for more information.

9. **Administrative Withdrawal:** A basic requirement of this course is that students participate in all class discussions and conscientiously complete all required course activities and/or assignments. If a student is unable to attend, participate in, or complete an assignment on time, it is the student’s responsibility to inform the instructor. If a student misses more than half of the required activities within the first 25% of the course without contacting the instructor, the student may be administratively withdrawn from this course. Administrative withdrawal may have academic, financial, and financial aid implications. Administrative withdrawal will take place after the full refund period, and a student who has been administratively withdrawn from a course is ineligible for a tuition refund. Contact the instructor with questions concerning administrative withdrawal.

10. **Emergency Preparedness:** Safety on campus is everyone’s responsibility. Know what to do in an emergency so that you can protect yourself and others. For specific information, visit the emergency management website. [http://protect.iu.edu/emergency](http://protect.iu.edu/emergency)

11. **Student Advocate:** The Student Advocate provides assistance to students with personal, financial, and academic issues. The Student Advocate Office is located in the Campus Center, Suite 350. The Student Advocate may also be contacted by phone at 317 274-4431 or by email at studvoc@iupui.edu. For more information visit [http://studentaffairs.iupui.edu/advocate](http://studentaffairs.iupui.edu/advocate).

12. **Counseling and Psychological Services (CAPS):** Students seeking counseling or other psychological services should contact the CAPS office by phone at 274-2548 or email at capsindy@iupui.edu. For more information visit [http://life.iupui.edu/caps/](http://life.iupui.edu/caps/).

**MISSION STATEMENT**
The Mission of IUPUI is to provide for its constituents excellence in
- Teaching and Learning;
- Research, Scholarship, and Creative Activity; and
- Civic Engagement.
With each of these core activities characterized by
   • Collaboration within and across disciplines and with the community;
   • A commitment to ensuring diversity; and
   • Pursuit of best practices.
IUPUI’s mission is derived from and aligned with the principal components—Communities of Learning, Responsibilities of Excellence, Accountability and Best Practices—of Indiana University’s Strategic Directions Charter.

STATEMENT OF VALUES
IUPUI values the commitment of students to learning; of faculty to the highest standards of teaching, scholarship, and service; and of staff to the highest standards of service. IUPUI recognizes students as partners in learning. IUPUI values the opportunities afforded by its location in Indiana’s capital city and is committed to serving the needs of its community. Thus, IUPUI students, faculty, and staff are involved in the community, both to provide educational programs and patient care and to apply learning to community needs through service. As a leader in fostering collaborative relationships, IUPUI values collegiality, cooperation, creativity, innovation, and entrepreneurship as well as honesty, integrity, and support for open inquiry and dissemination of findings. IUPUI is committed to the personal and professional development of its students, faculty, and staff and to continuous improvement of its programs and services.