GBIO0002 – Genetics and Bioinformatics

Montefiore Institute - Systems and Modeling

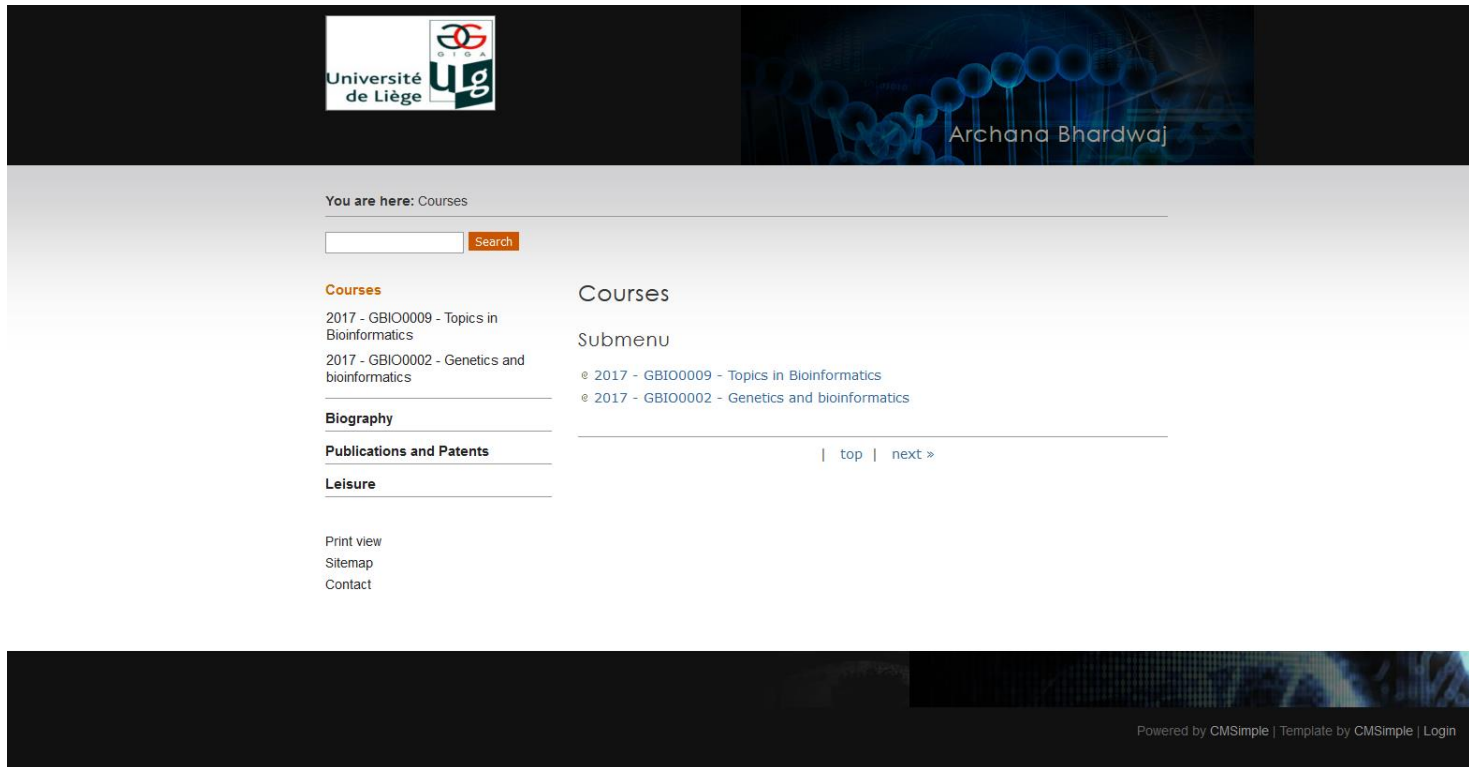**GIGA - Bioinformatics**

ULg

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Administration

- Course website 2017-2018 (appended with 2018-2019):
  http://bio3.giga.ulg.ac.be/archana_bhardwaj/?Courses__2017_-_GBIO0002_-_Genetics_and_bioinformatics

Kristel Van Steen, PhD²

Home

CV (Long - Updated)
Synopsis of activities

Consultancy Charter

FNRS CR Rita Brandão
References

Links to affiliations

- ULg homepage
- Institut Montefiore
- GIGA-R
- Center for Medical Genetics Ghent (at UG)
- Center for Human Genetics (at K.U.Leuven)
- ----X Marie Curie ITN: Machine Learning for Personalized Medicine
- ----X Pancreas COST Action: An integrated European platform for pancreas cancer research: from basic science to clinical and public health

Contact Information

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http://www.montefiore.ulg.ac.be/~kvansteen/
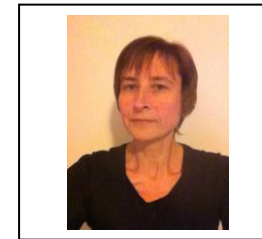
Administration

- Course instructors

Prof. Kristel Van Steen
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- – A.Bhardwaj@uliege.be

Administration

- Tutor-student commitments (progcours.ulg.ac.be)

Prerequisite knowledge and skills

A background in biomedicine or informatics are a pro, but not essential.

Planned learning activities and teaching methods

The course is in part based on interactive ex-cathedra lectures and in part on interactive practical sessions. The exercise sessions allow students to become more familiar with the theoretical concepts introduced during the theory classes, and to broaden views on "genetics and bioionformatics" applications. They prepare students to successfully carry out their homework assignments, which will require performing independent searches for additional information, beyond - but related to - the class material.

Regarding the homework assignments, two homework styles may be presented: 1) literature-based (i.e., discussing a paper related to the class topic); 2) a classic style homework which may involve a mix of theoretical questions and data analysis assignments. Students can work in groups. At the end of the course, each group should have selected each homework style at least once. The literature-based homeworks will be discussed and presented in class.

What will we be doing?

- General course content

In this course genetic concepts are introduced that are necessary to understand a selection of bioinformatics related data analysis problems. To solve these problems a variety of analytic tools will be explained and exemplified. Different topics typically include:

- – The genome and genetic markers [genetics]
- – Genome-wide association studies [analytics]
- – Sequence technologies [genetics]
- – Sequence comparisons [analytics]
- – The transcriptome and proteome [genetics]
- – Gene co-expression [analytics]

What will we be doing?

- General course content

  - Genetics + Analytics
  - Focus on
    - Understanding key concepts / terminology and their context
    - Interpreting findings / analysis results (NOT CARRYING OUT overly-complicated analyses)

How will we do it?

"Theory" classes

- Course notes are primarily in English

- Main instructors: K Van Steen and F Dequiedt

- The "theory" course will be interactive in English/French:
    - In class discussion papers
    - Interpreting analysis findings: discussing different viewpoints
    - Slides as supporting framework ("syllabus")

How will we do it?

"Practical" classes

- "Homework assignments" constitute an important part of this class and make links to the theory and practical classes.

- Main tutor: Archana Bhardwaj

- Homeworks: 2 styles

    - Reading assignment with presentation and in-class discussions (graded)

    - Classic homework style (Questions / Answer) assignments (graded)

- Homework assignments result in a "group" slides/report and should be handed in electronically in English

- See also documentation on course website + next slide

Organization of GBIO0002 Homework Assignments
Genetics and Bioinformatics

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Style 1: Literature project

This involves choosing a paper from the literature that extends or provides additional background on the material of the course (chapter) and then summarizing the paper, its objectives, results while further browsing the internet for additional information or supporting material.

Do not copy the paper, but show you have understood the main ideas of the paper and "discuss" the paper. Such a discussion could include thoughts on what was the key idea, strengths or weaknesses of the methods/experiments, comments on the writing, ways to extend the work, flaws in the argument/data/experiments, etc. Anything is fine, as long as it demonstrates some real thought. Especially for review papers, make sure one subtopic is worked out in more detail, by following up on referenced work or by searching the internet.

A selection of papers will be provided, but if you have another interesting paper to discuss, please send your suggestion to the TA. The course instructors will then decide whether the paper is eligible or not.

All literature projects will be presented and discussed in class. No report is needed. Only slides will do.

Style 2: Classic Q/A

Via representative questions, the idea is to further understand concepts provided in class. Occasionally, simulated or real-life data problems may be provided, that have been analyzed and for which the results require an interpretation. Use the material provided in class but be not afraid to consult the literature. As long as you can answer the given questions, everything is allowed. When you do use the literature, please provide references.

Please follow instructions in class, regarding how to draft your report.

General information regarding homework reports

Style 2 homework assignments may involve writing a short report of no more than the equivalent of 5 single-spaced typed pages of text, excluding figures, tables and bibliography. It should contain an abstract (e.g., depending on the homework style: description of the paper content, description of the problem) and a discussion part (see before). If citations are made to other papers, there should be a bibliography! Only one report per group is needed.

What will be evaluated?

- At the end of the course, you have acquired knowledge about **genetics** (in particular genomics, transcriptomics, technology-related aspects) and about a selection of state-of-the-art, yet basic, **analytic tools**.

- You will be evaluated about key concepts related to **genetics** and the analytic approaches presented during the course (incl. pros and cons, general contexts) and will be presented with a **few analysis results to interpret**.

How will be evaluated?

HW1		HW2		Written Exam	Participation
Genetics	Analytics	Genetics	Analytics		
15	15	15	15	35	5

- No final grade without homeworks; No final grade without exam; Homeworks not handed in in time == ZERO

- Written exam in January (terminology, basic analytic contexts, interpretation – see before; multiple choice + open questions; printed course notes as "open book")

- Second term exam: written exam + worst homework on Analytics + worst homework on Genetics

How will be evaluated?

Literature style homeworks

[homework = discuss a paper]

- Discuss the paper in your slides
- Make links
  - with other papers,
  - between the paper(s) and the course,
  - between the paper(s) and additional info outside the course

Evaluation criteria – presentation

Criterium	Key words
Clarity	Concepts, slides content, slides composition, fellow students do not have questions regarding "new" statements (i.e., not covered in class) made on the slides or during the presentation
Illustrations on slide	Not too much; not only copy and paste from course but novel illustrations; supportive
Presentation Skills	Eager beaver (a person who is very enthusiastic about doing something)
Understanding	Presentation content as presented is understood: adequate reply to questions and comments (incl. those from fellow students)
Group dynamics	Scoring will be done on an individual basis; balanced partitioning of tasks

Evaluation criteria – report

Mainly refers to Q/A style of homeworks or in case of a second term exam and one of the worst homeworks was a literature style homework.

- Ability to formulate the research problem and to sketch the context (introductions, data description, tool description, etc)
- Presentation summary of the analysis workflow (methods, analysis section)
- Discussion (of the analysis tools, of the quality of the analysis, validity of results – when put in a broader context, …)
- Creative input (stuffing, conclusion section)
- General structure of the report (sectioning)

Tentative course layout

Genetics and bioinformatics (R.21, B28)			2018-2019
18-Sep	KVS + TA	Meet & Greet, Course organization; What to expect? -- Data bases and R tutorial	
25-Sep	FD	Genetics and Genetic markers; Variant Calling	
02-Oct	KVS	Genetic mapping using GWAS: Why, What, How?	
09-Oct	TA	GWAS in practice: focus on GenABEL	HW1 assignment
16-Oct	KVS	Complicating factors in Bionformatics Analytics: Confounders; Sparse Data	
23-Oct	TA	Dealing with complicating factors in practice: focus on confounding	
30-Oct			
06-Nov	KVS	Sequence comparisons: Recognizing Words	HW1 due
13-Nov	FD + TA	Principles of sequencing: DNA, RNA	
		Handling sequence data in practice: focus on alignment --	HW2 assignment
20-Nov	ALL	HW1 presentations and discussion / Feedback on HW1	
27-Nov	FD	Principles of gene expression and proteomics data generation	
04-Dec	FD + TA	RNA-seq analyses in practice: focus on differentation and co-expression --	
		Protein interactions	
11-Dec	ALL	HW2 presentations and discussion	HW2 due
18-Dec	ALL	Opportunity for Q&A to exam / Course survey	

Questions?