

Algorithms for Computational Biology

Zsuzsanna Lipták

Masters in Molecular and Medical Biotechnology
a.a. 2015/16, fall term

Organisation

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- **course times:** Thu 10:30 - 12:30 (aula L), Fri 13:30 - 16:30 (aula H)
- **language:** English, but you can ask questions in English or in Italian
- **webpage:** coming soon!
will include: current info, slides, materials etc.
- **attendance:** not obligatory but recommended
(not all material will be available on webpage, plus:
read what I wrote on the webpage of the course)

Organisation (cont.)

- **email:** `zsuzsanna.liptak@univr.it`
Please put "Algorithms for Computational Biology" in the subject line
- **office:** CV 2, 1st floor, room 1.79
- **student hours:** **Wed 10:30-12:30 ???**

Organisation (cont.)

- this course is 6 CFU
- exam:
written and oral: admitted to oral only if you pass the written test
- for those who want this course to count for the Masters in Medical Bioinformatics (Dip. Inf.): it can replace 6 CFU of the "Fundamental Algorithms in Comp. Biology" **only if you do an additional assignment** on a topic from algorithms in computational biology (to be chosen together with lecturer)

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Questions?

Goals of this course

1. to learn about some basic **problems and algorithms** behind common bioinformatics applications (sequence alignment, sequence similarity, phylogenetic reconstruction)
2. to get an idea of some basic **computational issues** involved (problem specification, efficiency, limitations)

Overview

- Part I: Sequence Analysis
 - Pairwise sequence alignment
 - **Detour:** Algorithm analysis
 - Multiple sequence alignment
 - String similarity and distance
 - Scoring matrices
 - Heuristic database search: FASTA, BLAST
- Part II: Phylogenetics
 - **Detour:** Trees and graphs
 - algorithms for distance-based data
 - character-based data, Perfect Phylogeny
 - Small Parsimony: Fitch's algorithm
 - Large Parsimony: heuristics

Books

- **Neil C. Jones and Pavel A. Pevzner:** An Introduction to Bioinformatics Algorithms (2004).—3 copies in library
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- **João Setubal, João Meidanis**: Introduction to Computational Molecular Biology (1997).—my favourite, 1 copy in library
- **Dan Gusfield**: Algorithms on Strings, Trees, and Sequences (1997).—the bible of string algorithms, a bit dated now
- **Joseph Felsenstein**: Inferring Phylogenies (2004).—important book on phylogenetics, very understandably written
- **Cormen, Leiserson, Rivest (& Stein)**: Introduction to Algorithms (different editions, 1990-onwards).—the bible of algorithms, a must have for anyone interested in algorithms (buy second hand, old editions are also fine)