

# Computational Molecular Biology

## Biologia Computazionale

Romeo Rizzi and Riccardo Velasco

### aims of the course

The course is meant as a gentle introduction to the field of Computational Molecular Biology. A follow up course, held by Giuseppe Lancia, will touch upon more advanced research topics in Algorithms and Discrete Mathematics for Molecular Biology.

The main aims of the course, in order of priority, are:

1. Introduce to the field of Computational Molecular Biology;
2. Elucidate the role of algorithms in the current practice of the research in Molecular Biology;
3. Motivate the study of Algorithms and Discrete Mathematics techniques with applications in Molecular Biology;
4. Serve as a pre-course to the course of Giuseppe. During his course, Giuseppe will propose us open problems in the field as they are felt relevant by the main groups and companies working on the edge of present research. Giuseppe is a part-time researcher at Padua University (in the group of Apostolico) and partially works at Celera Genomix.

### reference book

- João Setubal and João Meidanis. **Introduction to Computational Molecular Biology.** *PWS Publishing Company* ITP An International Thomson Publishing Company. ISBN 0-534-95262-3

**You can ask for zerox-copies of the above book at the apposite office (Faculty of Science, close to the Library).**

**Puoi richiedere le fotocopie del testo consigliato qui sopra all'apposito ufficio fotocopie (Facoltà di Scienze, vicino alla biblioteca).**

### program

1. Basic Concepts of Molecular Biology (Riccardo Velasco);
  - 1.1 Proteins and amino acids. Nucleic Acids: DNA and RNA;
  - 1.2 The Mechanisms of Molecular Genetics;
  - 1.3 How the Genome is Studied;
2. Sequence Comparison (Romeo Rizzi);
  - 2.1 Comparing Two Sequences;

- 2.2 Extensions to the Basic Algorithms;
- 2.3 Comparing Multiple Sequences;
- 3. Database Search (Paolo Fontana);
  - 3.1 PAM Matrices;
  - 3.2 BLAST;
  - 3.3 FAST;
- 4. Physical Mapping of DNA;
  - 4.1 Biological Background (Riccardo Velasco);
  - 4.2 Physical Mapping of the vitis - an ongoing research project at S. Michele (Riccardo Velasco);
  - 4.3 The Interval Graph Model (Romeo Rizzi);
  - 4.4 The Consecutive Ones Property (Romeo Rizzi).

## calendario delle lezioni

|                                                                                                                                                             |               |           |                  |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|-----------|------------------|
| Lunedì 11                                                                                                                                                   | 8:30 - 10:00  | aula 14 A | Riccardo Velasco |
| Mercoledì 13                                                                                                                                                | 8:30 - 10:00  | aula 14 A | Romeo Rizzi      |
| Giovedì 14                                                                                                                                                  | 8:30 - 10:00  | aula 14 A | Romeo Rizzi      |
| Lunedì 18                                                                                                                                                   | 8:30 - 10:30  | aula 14 A | Romeo Rizzi      |
| Mercoledì 20                                                                                                                                                | 8:30 - 9:30   | aula 14 A | Riccardo Velasco |
| Mercoledì 20                                                                                                                                                | 11:30 - 13:00 | aula 14 A | Romeo Rizzi      |
| Giovedì 21                                                                                                                                                  | 8:30 - 9:30   | aula 14 A | Riccardo Velasco |
| Giovedì 21                                                                                                                                                  | 11:30 - 13:00 | aula 14 A | Romeo Rizzi      |
| Lunedì 25                                                                                                                                                   | 8:30 - 10:30  | aula 3    | Romeo Rizzi      |
| Mercoledì 27                                                                                                                                                | 8:30 - 10:30  | aula 5    | Romeo Rizzi      |
| Prevediamo inoltre la possibilità (data da destinarsi) di lezioni (pratiche?) di Paolo Fontana per la ricerca di sequenze biologiche in databases dedicati. |               |           |                  |

## calendar of the classes

|                                                                                                                                                   |                        |                |                  |
|---------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|----------------|------------------|
| Monday 11                                                                                                                                         | 8:30 a.m. - 10:00 a.m. | classroom 14 A | Riccardo Velasco |
| Wednesday 13                                                                                                                                      | 8:30 a.m. - 10:00 a.m. | classroom 14 A | Romeo Rizzi      |
| Thursday 14                                                                                                                                       | 8:30 a.m. - 10:00 a.m. | classroom 14 A | Romeo Rizzi      |
| Monday 18                                                                                                                                         | 8:30 a.m. - 10:30 a.m. | classroom 14 A | Romeo Rizzi      |
| Wednesday 20                                                                                                                                      | 8:30 a.m. - 9:30 a.m.  | classroom 14 A | Riccardo Velasco |
| Wednesday 20                                                                                                                                      | 11:30 a.m. - 1:00 p.m. | classroom 14 A | Romeo Rizzi      |
| Thursday 21                                                                                                                                       | 8:30 a.m. - 9:30 a.m.  | classroom 14 A | Riccardo Velasco |
| Thursday 21                                                                                                                                       | 11:30 a.m. - 1:00 p.m. | classroom 14 A | Romeo Rizzi      |
| Monday 25                                                                                                                                         | 8:30 a.m. - 10:30 a.m. | classroom 3    | Romeo Rizzi      |
| Wednesday 27                                                                                                                                      | 8:30 a.m. - 10:30 a.m. | classroom 5    | Romeo Rizzi      |
| It is possible that a few not compulsory (practical?) tutorials on the search of biological sequences in databases will be hold by Paolo Fontana. |                        |                |                  |

## language

Elementary English with Italian gesture. Everybody is welcome.

## **lingua**

Faremo ogni sforzo affinché quello della lingua non risulti essere un problema per nessuno.

## **prerequisites**

You know that living beings are made up of cells. You know what an algorithm is. After this, still you will need your own motivation and curiosity to enjoy your participation to the course.

## **exam**

The course gives 3 credits. If you are interested in these credits, then you must do the proposed homeworks and participate actively to the class. If you miss some lectures or fail some homeworks, you will be asked to present some further topic to the class. The teacher will help you entering this topic.

## **web site**

<http://www-math.science.unitn.it/~rrizzi/classes/BioComp/index.html>