LF132-15 Computational Biology

24/25

Department
Life Sciences
Level
Undergraduate Level 1
Module leader
Robin Allaby
Credit value
15
Module duration
10 weeks
Assessment
Multiple
Study location
University of Warwick main campus, Coventry

Description

Introductory description

This introductory undergraduate module provides a comprehensive overview of computational biology, equipping students with essential skills and knowledge in utilizing computational tools to analyze biological data. The course is designed to integrate theoretical understanding with practical application, fostering a holistic approach to the burgeoning field of computational biology.

This module provides a solid foundation for students to navigate the interdisciplinary field of computational biology, preparing them for more advanced studies and real-world applications in biological research and data analysis.

Module aims

- Provide students with a comprehensive understanding of fundamental concepts in computational biology, including the measurement of cellular entities and processes.
- Equip students with the skills to navigate and analyze biological databases, emphasizing effective data retrieval and interpretation.
- Develop proficiency in sequence searching and matching techniques, enabling students to analyze biological sequences and draw meaningful comparisons.

- Introduce the principles of phylogenetics, enabling students to interpret evolutionary relationships and construct phylogenetic trees.
- Familiarize students with artificial intelligence and machine learning applications in computational biology, fostering an understanding of their role in data analysis.
- Enable students to predict and analyze protein structures using computational tools, emphasizing the importance of structural insights in biological research.
- Introduce students to the principles of metagenomics, transcriptomics, and proteomics, providing a holistic view of high-throughput biological data analysis.
- Develop a solid grounding in statistical methods applied to computational biology, enabling students to critically evaluate and interpret biological data.
- Introduce students to static and dynamic systems in biology, emphasizing network analysis and computational modelling.
- Instil basic programming skills in students, allowing them to apply computational methods to biological data analysis and interpretation.
- Provide practical workshops to reinforce theoretical concepts, allowing students hands-on experience in utilizing computational tools for biological data analysis.
- Foster an interdisciplinary perspective by integrating biological principles with computational methodologies, preparing students for collaborative research endeavours.
- Develop critical thinking skills in students, enabling them to assess and solve complex biological problems using computational approaches.
- Cultivate effective communication skills in conveying computational biology concepts, results, and insights both orally and in writing.
- Raise awareness of ethical considerations in computational biology research and data analysis, encouraging responsible conduct in scientific practice.

Outline syllabus

This is an indicative module outline only to give an indication of the sort of topics that may be covered. Actual sessions held may differ.

15 lectures and 6 practical workshops to:

- Provide students with a comprehensive understanding of fundamental concepts in computational biology, including the measurement of cellular entities and processes.
- Equip students with the skills to navigate and analyze biological databases, emphasizing effective data retrieval and interpretation.
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Learning outcomes

By the end of the module, students should be able to:

- Provide students with a comprehensive understanding of fundamental concepts in computational biology, including the measurement of cellular entities and processes.
- Equip students with the skills to navigate and analyze biological databases, emphasizing effective data retrieval and interpretation.
- Develop proficiency in sequence searching and matching techniques, enabling students to analyze biological sequences and draw meaningful comparisons.
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Subject specific skills

- Skill in measuring cellular entities and processes.
    - Proficiency in quantitative analysis methods for cellular measurements.
    - Competence in applying sequence searching and matching techniques to analyze biological sequences.
    - Proficiency in assessing the significance of sequence alignments and identifying homologous regions.
    - Skill in constructing and interpreting phylogenetic trees based on molecular data.
    - Competence in applying phylogenetic analysis methods to understand evolutionary relationships.
        - Proficiency in predicting protein structures using computational tools.
    - Skill in analyzing the implications of structural predictions for understanding biological systems.
    - Competence in understanding and analyzing data from metagenomics, transcriptomics, and proteomics.
    - Competence in assessing the reliability and significance of computational biology results statistically.
    - Ability to understand and analyze static and dynamic systems in biology.
    - Competence in writing basic programs for biological data analysis.
    - Ability to apply sequence searching and matching techniques in practical scenarios.
    - Proficiency in constructing phylogenetic trees using software tools.
    - Skill in interpreting and communicating phylogenetic data effectively.
    - Ability to apply machine learning techniques to analyze biological data.
    - Proficiency in predicting protein structures and analyzing their implications.
    - Skill in applying computational tools for structural biology analysis in practical scenarios.

Transferable skills

- Ability to navigate and query databases effectively.
- Skill in retrieving and interpreting relevant information from diverse databases.
- Knowledge of the applications of artificial intelligence and machine learning.
- Ability to apply machine learning techniques to analyze and interpret data.
- Skill in applying statistical methods to analyze and interpret biological data.
- Proficiency in utilizing network analysis for comprehending complex systems.
- Proficiency in using programming languages.
- Skill in interpreting and discussing results obtained through machine learning approaches.
- Competence in writing basic programs for biological data analysis.
- Proficiency in using programming languages relevant to computational biology.

Study

Study time

Type	Required
Lectures	15 sessions of 1 hour (10%)
Practical classes	6 sessions of 1 hour 30 minutes (6%)
Private study	126 hours (84%)
Total	150 hours

Private study description

Independent learning, self directed learning and revision for exams.

Costs

No further costs have been identified for this module.

Assessment

You do not need to pass all assessment components to pass the module.

Assessment group D

	Weighting	Study time	Eligible for self-certification
In module assessment	80%		Yes (extension)

	Weighting	Study time	Eligible for self-certification
In course project based on analysis of sequences provided			
MCQ	20%		No
MCQ based exam and short answer questions			

Assessment group R

	Weighting	Study time	Eligible for self-certification
MCQ	100%		No
MCQ and short answers			

Feedback on assessment

Individual feedback will provided on all in module assessments

Cohort level feedback is provided for all end of year examinations

Past exam papers for LF132

Availability

Courses

This module is Core optional for:

- Year 1 of UBSA-3 Undergraduate Biological Sciences
- Year 1 of ULFA-C1A1 Undergraduate Biological Sciences (MBio)
- Year 1 of ULFA-C113 Undergraduate Biological Sciences (with Placement Year)
- Year 1 of ULFA-C1A5 Undergraduate Biological Sciences with Industrial Placement (MBio)
- Year 1 of UBSA-C1B9 Undergraduate Biomedical Science
- ULFA-C1A3 Undergraduate Biomedical Science (MBio)
    - Year 1 of C1A3 Biomedical Science
    - Year 1 of C1B9 Biomedical Science
- Year 1 of ULFA-CB18 Undergraduate Biomedical Science with Placement Year

This module is Optional for:

- Year 1 of ULFA-C1A7 Undergraduate Biomedical Science with Industrial Placement (MBio)
- Year 1 of ULFA-B142 Undergraduate Neuroscience (MBio)
- Year 1 of ULFA-B143 Undergraduate Neuroscience (with Industrial Placement) (MBio)
- Year 1 of ULFA-B141 Undergraduate Neuroscience (with Placement Year) (BSc)

This module is Option list A for:

- Year 1 of UBSA-C700 Undergraduate Biochemistry
- ULFA-C1A2 Undergraduate Biochemistry (MBio)
    - Year 1 of C1A2 Biochemistry
    - Year 1 of C700 Biochemistry
- Year 1 of ULFA-C702 Undergraduate Biochemistry (with Placement Year)
- Year 1 of ULFA-C1A6 Undergraduate Biochemistry with Industrial Placement (MBio)
- Year 1 of ULFA-B140 Undergraduate Neuroscience (BSc)