1. **Title of the module**

Proteins: Structure and Function

1. **School or partner institution which will be responsible for management of the module**

School of Biosciences

1. **The level of the module (e.g. Level 4, Level 5, Level 6 or Level 7)**

Level 6

1. **The number of credits and the ECTS value which the module represents**

30 credits (15 ECTS credits)

1. **Which term(s) the module is to be taught in (or other teaching pattern)**

Autumn term

1. **Prerequisite and co-requisite modules**

BI300, BI532

1. **The programmes of study to which the module contributes**

Biochemistry and related programmes.

Could be considered as an optional module for BSc Biomedical Science and related programmes and BSc Biology and related programmes if total numbers do not exceed the capacity of workshop provision in the Research Labs and Research Facilities.

1. **The intended subject specific learning outcomes.
On successfully completing the module students will have:**

8.1 An understanding of the structural organisation and biophysical properties of proteins together with their physiological function in terms of catalysis, ligand binding and as components of molecular machines. (Biochemistry programme outcomes: A1, A2, A4, A5, A11, B2)

8.2 An understanding of how the structure and function of proteins are studied and characterised using current biophysical methods such as mass spectroscopy, x-ray diffraction, nuclear magnetic resonance, fluorescence, circular dichroism, electron microscopy, atomic force microscopy, rapid mixing and relaxation apparatus. (Biochemistry programme outcomes: A4, A5, A10, A11, B2)

8.3 Experience of web-based tools to retrieve and manipulate protein-related data from international repositories, and the use of molecular graphics and modelling software to analyse protein structure in relation to topology and function. (Biochemistry programme outcomes: A4, A5, A10, B2, B3, B4, B6, C4, D1, D3, D4)

8.4 Familiarisation with the instrumentation and the type of data generated by the techniques listed in (2) above using modern research equipment in the Research Facilities and Research Labs of the School of Biosciences. (Biochemistry programme outcomes: A4, A5, A10, B2, B3, B4, B5, B6, C1, C4, C5, D1, D3, D4)

1. **The intended generic learning outcomes.
On successfully completing the module students will have developed skills in:**

9.1 Written communication (Biochemistry programme outcomes: A11, D2)

9.2 Handling and analysis of experimental data (including numerical data) (Biochemistry programme outcomes: B3, B4, B5, C5, C6, D1, D3, D4)

9.3 Problem solving (Biochemistry programme outcomes: B2, B4, B5, B6, D1, D3)

9.4 Use of web tools, data repositories, and computer software. (Biochemistry programme outcomes: C4, D1, D3, D4)

1. **A synopsis of the curriculum**

Structural organisation of proteins (including folding motifs and protein fold classification)

Modern Enzymology (in principle and practice)

Optical probes for structure/function analysis (fluorescence and CD)

Mass spectrometry

Ligand binding assays

Structural analysis of protein assemblies (cryo-EM, AFM, SAXS)

X-ray crystallography

NMR

Enzyme catalysis

Molecular machines (transport motors, energy transducers, switches/signals and DNA processing)

Protein folding

Modelling of protein structure and function

Protein engineering and design

Molecular processing

1. **Reading List (Indicative list, current at time of publication. Reading lists will be published annually)**

Williamson, M. (2011) How proteins work. Garland Science

Lesk, A.M. (2010, 2nd ed.) Introduction to protein science. Architecture, function and genomics. Oxford University Press

Price & Nairn (2009) Exploring proteins. Oxford University Press

Whitford, D. (2005) Proteins: structure and function. J. Wiley & sons.

Rhodes G (2006, 3rd ed.) Crystallography made crystal clear. Academic Press

1. **Learning and Teaching methods**

**Total contact = 70 h**

Lectures (44 x 1 h)

Revision session (electrophoresis/chromatography) (1 x 2 h)

Problem solving supervisions (4 x 2 h)

Practical/ data analysis workshops (6 x 1.5 h)

Molecular graphics and workshop feedback sessions (7 x 1h)

**Self Study = 230 h**

Workshop assessments (3 x 18h)

Molecular graphics assessment (18 h)

Preparation for problem solving sessions (4 x 3 h)

Recommended reading (96 h)

Revision/preparation for end-of-year exams (50 h)

1. **Assessment methods.**

***Course assessment = 40%, Exam = 60%***

**Course work assessments (40% of total)**

Web-tools and molecular graphics 10%

Data analysis/interpretation from 6 workshop sessions. The workshop sessions are paired to make 3 assessment; (a) fluorescence/CD/mass spectrometry, (b) kinetics/atomic force microscopy/electron microscopy, (c) x-ray crystallography/NMR. (3 x 10%)

**End-of-year exams (each paper 2 h; 60% of total)**

Paper 1 (2 essay questions from 6) 30% Paper 2 (2 problem questions from 3) 30%

1. ***Map of Module Learning Outcomes (sections 8 & 9) to Learning and Teaching Methods (section12) and methods of Assessment (section 13)***

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Module learning outcome** |  | *8.1* | *8.2* | *8.3* | *8.4* | *9.1* | *9.2* | *9.3* | *9.4* |
| **Learning/ teaching method** | **Hours allocated** |  |  |  |  |  |  |  |  |
| **Contact Time:** |  |  |  |  |  |  |  |  |  |
| Lectures | *44* | x | x |  |  |  |  |  |  |
| Revision session (electrophoresis/ chromatography) | *2* | x | x |  |  |  | x |  |  |
| Problem solving supervisions (x4) | *8* | x | x |  |  |  | x | x |  |
| Practical/data analysis workshops (x6) | *9* | x | x | x | x | x | x | x | x |
| Molecular graphics and workshop feedback sessions (x7) | *7* | x | x | x | x |  | x | x | x |
| **Private Study:** |  |  |  |  |  |  |  |  |  |
| *Workshop assessments* | *54* | x | x |  | x | x | x | x | x |
| *Molecular graphics assessment* | *18* | x |  | x |  |  | x | x | x |
| *Preparation for problem solving supervisions* | *12* | x | x |  |  |  | x | x |  |
| *Recommended reading* | *96* | x | x |  | x |  |  |  | x |
| *Revision/ preparation for end-or-year exams* | *50* | x | x |  | x |  | x | x |  |
| **Assessment method** |  |  |  |  |  |  |  |  |  |
| ***Coursework****- Handling and analysis of experimental data* |  | x | x | x | x | x | x | x | x |
| ***Coursework****- Interpretation of experimental data* |  | x | x | x | x | x | x | x |  |
| ***Exam*** *– Essay* |  | x | x |  |  | x |  |  |  |
| ***Exam*** *– problem solving* |  | x | x | x |  | x | x | x |  |

1. **The School recognises and has embedded the expectations of current disability equality legislation, and supports students with a declared disability or special educational need in its teaching. Within this module we will make reasonable adjustments wherever necessary, including additional or substitute materials, teaching modes or assessment methods for students who have declared and discussed their learning support needs. Arrangements for students with declared disabilities will be made on an individual basis, in consultation with the University’s disability/dyslexia student support service, and specialist support will be provided where needed.**
2. **Campus(es) or Centre(s) where module will be delivered:**

Canterbury

**FACULTIES SUPPORT OFFICE USE ONLY**

**Revision record – all revisions must be recorded in the grid and full details of the change retained in the appropriate committee records.**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Date approved | Major/minor revision | Start date of the delivery of revised version | Section revised | Impacts PLOs( Q6&7 cover sheet) |
| 07/12/15 | Minor | September 2015 | 13 | No |
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