

School of Biology

Important Degree Information:

B.Sc./M.A. Honours

The general requirements are 480 credits over a period of normally 4 years (and not more than 5 years) or part-time equivalent; the final two years being an approved Honours programme of 240 credits, of which 90 credits are at 4000-level and at least a further 120 credits at 3000- and/or 4000-levels. Refer to the appropriate Faculty regulations for lists of subjects recognised as qualifying towards either a B.Sc. or a M.A. degree.

B.Sc./M.A. Honours with Integrated Year Abroad

The general requirements are 540 credits over a period of normally 5 years (and not more than 6 years) or part-time equivalent; the final three years being an approved Honours programme of 300 credits, of which 60 credits are gained during the integrated year abroad, 90 credits are at 4000 level and at least a further 120 credits at 3000 and/or 4000 levels. Refer to the appropriate Faculty regulations for lists of subjects recognised as qualifying towards either a B.Sc. or M.A. degree.

Other Information: In the case of students who spend part of the Honours programme abroad on a recognised Exchange Scheme, the Programme Requirements will be amended to take into account courses taken while abroad. With the permission of the Director of Teaching up to 20 credits per programme may be taken in a module outwith the specified modules in the above Programmes. Entry to the Honours programme is at the discretion of the Director of Teaching, but is automatically granted for students gaining at least grade 11 in two of the prerequisite second year modules. Those who, at their first attempt, earn a minimum aggregate of 35 grade points from 2000-level Biology modules will also be considered for entry. Where there are choices between modules in the programmes that follow, some options may have pre-requisites so that choices may be limited by the Pre-honours modules taken. *The availability of 4000-level modules in the School of Biology will be dependent on sufficient student demand.*

Degree Programmes	Programme Requirements at:
(B.Sc. Honours): Behavioural Biology	<p>Single Honours Behavioural Biology Degree:</p> <p>Level 1: At least 40 credits comprising passes in (BL1201 and either BL1001 or BL1002) or (BL1101 and BL1102).</p> <p>Level 2: at least 60 credits including BL2102 and BL2105.</p> <p>Level 3: 130 credits comprising BL3000, BL3306, BL3307, BL3308, BL3319, BL3320; and two from BL3309, BL3313, BL3315, BL3316, BL3318.</p> <p>Level 4: BL4200 or BL4202 and FIVE other modules, OR BL4201 and FOUR other modules. Other modules to be chosen will be four or five from BL3400, BL4232, BL4234, BL4235, BL4256, BL4258, BL4261, BL4280 - BL4286, BL4290; but may also include ONE of BL4291 - BL4293, ID4001. One 4000-level BL module not specified here may be taken as an alternative, with the permission of the Degree Controller and Director of Teaching.</p>
(B.Sc. Honours): Biochemistry	<p>Single Honours Biochemistry Degree:</p> <p>Level 1: 40 credits comprising passes in (BL1001 and BL1201. BL1002 is also recommended for all students considering Honours Programmes in the School of Biology) or (BL1101 and BL1102).</p> <p>Level 2: At least 60 credits including BL2101 and BL2104.</p> <p>Level 3: 125 credits comprising BL3301, BL3302, BL3303, BL3310, BL3320; and two from BL3311, BL3312, BL3313.</p> <p>Level 4: BL4200 or BL4202, BL4210 and FOUR other modules, OR BL4201, BL4210 and THREE other modules. Other modules to be chosen will be three or four from BL4211 - BL4216, BL4221-BL4224, BL4230 and BL4273; but may also include ONE of BL4219, BL4220, BL4255, BL4291- BL4293, ID4001. One 4000-level BL module not specified here may be taken as an alternative, with the permission of the Degree Controller and Director of Teaching.</p>

Biology – Honours 2011/12 – January 2012

Degree Programmes	Programme Requirements at:
<p>(B.Sc. Honours): Biology</p>	<p>Single Honours Biology Degree:</p> <p>Level 1: At least 40 credits comprising passes in (BL1201 and either BL1001 or BL1002) or (BL1101 and BL1102).</p> <p>Level 2: At least 60 credits from 2000-level modules available in the School of Biology</p> <p>Level 3: 120-130 credits including BL3320, and then comprising a free choice of modules as approved by the Degree Controller & Director of Teaching. Students on this programme are expected to study across a wide range of sub-disciplines within Biology. BL3000 is required if BL3308 or BL3309 are taken.</p> <p>Level 4: BL4200 or BL4202 and FIVE other modules, OR BL4201 and FOUR other modules; the other modules comprising a free choice (including BL3400) as approved by the Degree Controller and Director of Teaching but may also include ONE of BL4291 - BL4293, ID4001.</p>
<p>(B.Sc. Honours): Biology and Economics</p>	<p>Biology element Joint Honours Biology and Economics Degree:</p> <p>Level 1: At least 40 credits comprising passes in (BL1201 and either BL1001 or BL1002) or (BL1101 and BL1102).</p> <p>Level 2: 60 credits including any two 2000-level BL modules with a grade 11 pass in each.</p> <p>Level 3: 65 credits from modules BL3301-BL3320; 20 credits will normally be taken in Semester 1 and 40 credits in Semester 2. BL3320 is compulsory for all students.</p> <p>BL3000 is required if BL3308 or BL3309 are taken.</p> <p>Level 4: 60 credits from any 4000-level BL modules (including BL3400), but may also include ONE of BL4291 - BL4293, ID4001.</p>
<p>(B.Sc. Honours): Biology and Geology</p>	<p>Biology element of Joint Honours Biology and Geology Joint Degree:</p> <p>Level 1: At least 40 credits comprising passes in (BL1201 and either BL1001 or BL1002) or (BL1101 and BL1102).</p> <p>Level 2: 60 credits including (BL2102 or BL2103); and BL2105</p> <p>Level 3: 45-85 credits taken from BL3000, BL3306, BL3307, BL3308, BL3309, BL3316, BL3318, BL3319, BL3320. BL3320 is compulsory for all students.</p> <p>Level 4: 45-75 credits taken from BL3400, BL4220, BL4260, BL4261, BL4265 - BL4275, BL4286; but may also include ONE of BL4291 - BL4293, ID4001. One 4000-level BL module not specified here may be taken as an alternative, with the permission of the Degree Controller and Director of Teaching.</p> <p>Modules from Levels 3 and 4 should give a total of 240 credits comprising 105-135 from each School.</p>

Degree Programmes	Programme Requirements at:
<p>(B.Sc. Honours): Biology and Mathematics or Statistics</p>	<p>Biology element of Joint Honours Biology Degree:</p> <p>Level 1: At least 40 credits comprising passes in BL1101 and BL1102</p> <p>Level 2: At least 60 credits from 2000-level modules available in the School of Biology</p> <p>Level 3: 40-60 credits from 3000-level modules available in the School of Biology, plus BL3320.</p> <p>Level 4: At least 60 credits from 4000-level modules available in the School of Biology (and including BL3400), and must include one of BL4200, BL4202 OR BL4201.</p> <p>Modules from Levels 3 and 4 should give a total of 240 credits comprising 105-135 from each School.</p>
<p>(B.Sc. Honours): Biology and Psychology</p>	<p>Biology element Joint Honours Biology and Psychology Degree:</p> <p>Level 1: At least 40 credits comprising passes in (BL1201 and either BL1001 or BL1002) or (BL1101 and BL1102).</p> <p>Level 2: 60 credits including any two 2000-level BL modules with a grade 11 pass in each.</p> <p>Level 3: 40-65 credits from BL3000 level modules, which must include BL3320, as approved by the Degree Controller.</p> <p>Level 4: At least 45 credits comprising 4000-level BL modules as approved by the Degree Controller but may also include ONE of BL4291 - BL4293, ID4001.</p> <p>Note: The total Honours credits in Biology and Psychology must equal or exceed 240, and must include a project in either School (PS4050 or BL4200).</p>
<p>(B.Sc. Honours): Biology with French</p>	<p>Biology major element of B.Sc. Honours Degree with French:</p> <p>Level 1: At least 40 credits comprising passes in (BL1001 and BL1201) or (BL1101 and BL1102).</p> <p>Level 2: EITHER:</p> <p>60 credits comprising passes at grade 11 or better in two of BL2101, BL2102, BL2104 or BL2105; and 20 credits from SD1001 or ID2003 and ID2004</p> <p>OR</p> <p>90 credits comprising passes in three of BL2101, BL2102, BL2104 or BL2105, at least two of which are at grade 11 or better.</p> <p>Level 3: 95 credits from 3000-level BL modules and 30 credits comprising FR3001 and FR3002. BL3320 is compulsory for all students.</p> <p>Level 4: 90 credits comprising (BL4201 and two modules) OR (BL4200 or BL4202 and three modules) but may also include ONE of BL4291 - BL4293, ID4001 and 30 credits comprising FR4105 and FR4106.</p>

Degree Programmes	Programme Requirements at:
<p>(B.Sc. Honours):</p> <p>Biology with French With Integrated Year Abroad</p>	<p>Biology & French elements of B.Sc. Honours Degree with French:</p> <p>Level 1: Biology Element: At least 40 credits comprising passes in (BL1001 and BL1201) or (BL1101 and BL1102).</p> <p>French Element: 40 credits comprising passes in FR1001 and FR1002.</p> <p>Level 2: Biology Element EITHER:</p> <p>60 credits comprising passes at grade 11 or better in two of BL2101, BL2102, BL2104 or BL2105; and 20 credits from SD1001 or ID2003 and ID2004 OR</p> <p>90 credits comprising passes in three of BL2101, BL2102, BL2104 or BL2105, at least two of which are at grade 11 or better.</p> <p>French Element: 40 credits comprising a pass in FR2021 and a pass at grade 11 or better in FR2022.</p> <p>Year Abroad: 60 credits comprising FR3101</p> <p>Level 3: 95 credits from 3000-level BL modules and 30 credits comprising FR3001 and FR3002. BL3320 is compulsory for all students.</p> <p>Level 4: 90 credits comprising (BL4201 and two modules) OR (BL4200 or BL4202 and three modules) but may also include ONE of BL4291 - BL4293, ID4001 and 30 credits comprising FR4105 and FR4106.</p>
<p>(B.Sc. Honours):</p> <p>Biology with German^W or Spanish^N</p> <p>^WAlso available as 'with Integrated Year Abroad Degrees'</p> <p>^NNot available to entrants from 2008-09</p>	<p>Biology major element of B.Sc. Honours Degree with German or Spanish:</p> <p>Level 1: At least 40 credits comprising passes in (BL1201 and either BL1001 or BL1002) or (BL1101 and BL1102).</p> <p>Level 2: 60 credits from the 2000-level modules available in the School of Biology.</p> <p>Levels 3 & 4: 185 credits from BL modules.</p> <p>BL3320 is compulsory for all students and BL3000 is required if BL3308 or BL3309 are taken.</p> <p>Typically at level 4000: BL4200 or BL4202 and 3 or 4 other 4000-level BL 15 credit modules, OR BL4201 and 2 or 3 other 4000-level BL 15 credit modules. Other modules to be chosen will be from the groups defined for a Single Honours Degree, subject to the permission of the Degree Controller and Director of Teaching.</p>
<p>(B.Sc. Honours):</p> <p>Psychology with Biology</p>	<p>Biology minor element of Psychology with Biology B.Sc. Honours Degree:</p> <p>Level 1: At least 40 credits comprising passes in (BL1201 and either BL1001 or BL1002) or BL1101 and BL1102).</p> <p>Level 2: 60 credits from the 2000-level modules available in the School of Biology.</p> <p>Level 3: Up to 45 credits from 3000-level BL modules as approved by the Degree Controller. These may be taken in year 3 or 4. BL3320 is compulsory for all students.</p> <p>Level 4: At least 45 credits comprising 4000-level BL modules as approved by the Degree Controller.</p> <p>Note: The total Honours credits in Biology and Psychology must equal or exceed 240 and must include a project in either School (PS4050 or BL4200)</p>

Degree Programmes	Programme Requirements at:
<p>(B.Sc. Honours):</p> <p>Biomolecular Science</p> <p>(note admission to this degree is via the School of Chemistry)</p>	<p>Single Honours Biomolecular Science Degree:</p> <p>Level 1: Biology Element: 40 credits including passes in (BL1001 and BL1201) or (BL1101 and BL1102).</p> <p>Chemistry Element: 40 credits comprising passes in CH1401 and CH1601.</p> <p>Level 2: 120 credits comprising passes at 11 or better in BL2101, BL2104, CH2501 and CH2601.</p> <p>Level 3: 125 credits comprising Biology Element: BL3301, BL3310, BL3312, BL3320 Chemistry Element: CH3611, CH3612, CH3613, CH3621, CH3432, CH3716.</p> <p>Level 4: 120 credits comprising:</p> <p>Biology element: BL4210 and THREE modules chosen from (BL4212, BL4213, BL4215, BL4216, BL4222, and BL4223)#.</p> <p>Chemistry element: CH4442 and TWO other modules chosen from CH4611, CH4612, CH4613, CH5611, CH5612, CH5613, CH5614, CH5616.</p> <p>(By special arrangement only, BL4201 may be taken instead of CH4442; but modules chosen from # must then be eliminated and five 10 credit CH modules taken.)</p> <p>Chemistry: Direct entry into Level 2 is possible, in which case 120 advanced standing credits at Level 1 are given.</p> <p>In the case of students who spend part of the Honours Programme abroad on a recognised Exchange Scheme, the Programme Requirements will be amended to take into account courses taken while abroad.</p> <p>Other Information: This course is recognised by the Royal Society of Chemistry (RSC) for professional membership.</p>
<p>(B.Sc. Honours):</p> <p>Cell Biology</p>	<p>Single Honours Cell Biology Degree:</p> <p>Level 1: 40 credits comprising passes in (BL1001 and BL1201) or (BL1101 and BL1102).</p> <p>Level 2: at least 60 credits including BL2101 and BL2104.</p> <p>Level 3: 125 credits comprising BL3301, BL3302, BL3303, BL3320; and three from BL3310, BL3311, BL3312, BL3313, BL3315.</p> <p>Level 4: BL4200 or BL4202 and FIVE other modules, OR BL4201 and FOUR other modules. Other modules to be chosen will be four or five from BL4210*, BL4211 - BL4221, BL4223, BL4224, BL4230 - BL4234, BL4273; but may also include ONE of BL4290 - BL4293, ID4001. One 4000-level BL module not specified here may be taken as an alternative, with the permission of the Degree Controller and Director of Teaching.</p> <p>*BL4210 should normally be taken by any student whose project supervisor is in the Biomedical Sciences Research Complex (BRSC).</p>

Degree Programmes	Programme Requirements at:
<p>(B.Sc. Honours):</p> <p>Ecology & Conservation</p>	<p>Single Honours Ecology & Conservation Degree:</p> <p>Level 1: At least 40 credits comprising passes in [BL1201 and either BL1001 or BL1002 (BL1002 is recommended).] or [BL1101 and B11102].</p> <p>Level 2: at least 60 credits including (BL2102 or BL2103) and BL2105.</p> <p>Level 3: 130 credits including BL3000, BL3306, BL3307, BL3308, BL3309, BL3320; and two from BL3316, BL3318, BL3319.</p> <p>Level 4: BL4200 or BL4202 and FIVE other modules, OR BL4201 and FOUR other modules. Other modules to be chosen will be four or five from BL3400, BL4219, BL4220, BL4249, BL4251, BL4257 - BL4261, BL4265 - BL4273, BL4275, BL4282, BL4285, BL4286; but may also include ONE of BL4290 - BL4293, BL4301, ID4001. One 4000-level BL module not specified here may be taken as an alternative, with the permission of the Degree Controller and Director of Teaching.</p>
<p>(B.Sc. Honours):</p> <p>Environmental Biology & Geography</p>	<p>Environmental Biology element of Geography Joint Honours Degree:</p> <p>Level 1: At least 40 credits comprising passes in (BL1201 and either BL1001 or BL1002) or (BL1101 and BL1102).</p> <p>Level 2: 60 credits including BL2102 or BL2103; and BL2105.</p> <p>Level 3: 60-70 credits comprising any three of BL3306, BL3307, BL3308, BL3309, BL3316, BL3318, BL3319, BL3320.</p> <p>BL3320 is compulsory for all students.</p> <p>BL3000 is also required if BL3308 or BL3309 are taken.</p> <p>Level 4: Any four modules from BL3400, BL4219, BL4220, BL4251, BL4260, BL4265 - BL4275, BL4286; but may also include ONE of BL4291 - BL4293, ID4001. One 4000-level BL module not specified here may be taken as an alternative, with the permission of the Degree Controller and Director of Teaching.</p>
<p>(B.Sc. Honours):</p> <p>Environmental Biology & Environmental Geoscience or Geoscience</p> <p>Not available to entrants from 2012-13</p> <p>See Biology and Geology (page 5.2)</p>	<p>Environmental Biology element of Geoscience Joint Honours Degrees:</p> <p>Level 1: At least 40 credits comprising passes in (BL1201 and either BL1001 or BL1002) or (BL1101 and BL1102).</p> <p>Level 2: 60 credits including (BL2102 or BL2103); and BL2105</p> <p>Level 3: 45-85 credits taken from BL3000, BL3306, BL3307, BL3308, BL3309, BL3316, BL3318, BL3319, BL3320. BL3320 is compulsory for all students.</p> <p>Level 4: 45-75 credits taken from BL3400, BL4220, BL4260, BL4261, BL4265 - BL4275, BL4286; but may also include ONE of BL4251, BL4291 - BL4293, ID4001. One 4000-level BL module not specified here may be taken as an alternative, with the permission of the Degree Controller and Director of Teaching.</p> <p>Modules from Levels 3 and 4 should give a total of 240 credits comprising 105-135 from each School.</p>

Degree Programmes	Programme Requirements at:
<p>(B.Sc. Honours): Evolutionary Biology</p>	<p>Single Honours Evolutionary Biology Degree:</p> <p>Level 1: At least 40 credits comprising passes in (BL1201 and either BL1001 or BL1002) or (BL1101 and BL1102).</p> <p>Level 2: At least 60 credits including (BL2102 or BL2103) and BL2105.</p> <p>Level 3: 120-130 credits comprising BL3307 and BL3320; and five from BL3302, BL3306, BL3308, BL3309, BL3313, BL3315, BL3316, BL3318, BL3319.</p> <p>BL3000 is also required if BL3308 or BL3309 are taken.</p> <p>Level 4: BL4200 or BL4202 and FIVE other modules, OR BL4201 and FOUR other modules. Other modules to be chosen will be four or five from BL3400, BL4218, BL4219, BL4251, BL4272 - BL4275, BL4280, BL4282, BL4284, BL4286, BL4290, BL4292; but may also include ONE of BL4291, BL4293, ID4001. One 4000-level BL module not specified here may be taken as an alternative, with the permission of the Degree Controller and Director of Teaching.</p>
<p>(B.Sc. Honours): Marine Biology</p>	<p>Single Honours Marine Biology Degree:</p> <p>Level 1: At least 40 credits comprising passes in (BL1201 and either BL1001 or BL1002) or (BL1101 and BL1102).</p> <p>Level 2: 120 credits from 2000-level Biology modules which must include BL2102 and BL2105.</p> <p>Level 3: 130 credits comprising BL3000, BL3306, BL3308, BL3318 and BL3320; and three from BL3307, BL3309, BL3313, BL3315, BL3316, BL3319.</p> <p>Level 4: BL4200 or BL4202 and FIVE other modules, OR BL4201 and FOUR other modules. Other modules to be chosen will be at least THREE from BL4249 - BL4261, but may also include ONE from BL4247, BL4248, BL4265 - BL4269, BL4273, BL4274, BL4281, BL4286, BL4290, and ONE from BL4291-BL4293, BL4301, ID4001. One 4000-level BL module not specified here, or BL3400, may be taken as an alternative, with the permission of the Degree Controller and Director of Teaching.</p>
<p>(B.Sc. Honours): Molecular Biology</p>	<p>Single Honours Molecular Biology Degree:</p> <p>Level 1: 40 credits including passes in (BL1001 and BL1201. BL1002 is also recommended for all students considering Honours Programmes in the School of Biology.) or (BL1101 AND BL1102).</p> <p>Level 2: At least 60 credits including BL2101 and BL2104.</p> <p>Level 3: 125 credits comprising BL3301, BL3302, BL3303, BL3310, BL3311 and BL3320; and either BL3312 or BL3315.</p> <p>Level 4: BL4200 or BL4202, BL4210 and FOUR other modules, OR BL4201, BL4210 and THREE other modules. Other modules to be chosen will be three or four from BL4211 - BL4216, BL4221, BL4223, BL4224 and BL4230; but may also include ONE of BL4219, BL4220, BL4255, BL4273, BL4291 - BL4293, ID4001. One 4000-level BL module not specified here may be taken as an alternative, with the permission of the Degree Controller and Director of Teaching.</p>

Degree Programmes	Programme Requirements at:
<p>(B.Sc. Honours):</p> <p>Neuroscience</p> <p>(these requirements have been amended for 2009-10 - students entering the programme before this time should consult the entry above or previous Catalogues)</p>	<p>Single Honours Neuroscience Degree:</p> <p>Level 1: At least 40 credits comprising passes in (BL1201 and either BL1001 or BL1002) or (BL1101 and BL1102), and 40 credits comprising passes in PS1001 and PS1002.</p> <p>Level 2: 60 credits including BL2101 and at least one of BL2104 or BL2106, and 60 credits comprising passes in PS2001 and PS2002.</p> <p>Level 3: 45 credits from Biology modules comprising BL3303, BL3313 and BL3320 and 40 credits from Psychology modules comprising PS3035, PS3032 and, normally, PS3037 and PS3038. Modules not to exceed 125 credits for the whole year to be chosen from relevant Biology and Psychology modules.</p> <p>Level 4: BL4200 or BL4201 or PS4050. Up to 90 credits from relevant Biology and Psychology modules, that may include only one of BL4291 - BL4293 and ID4001. Students taking BL4200 will not be permitted to take PS4060.</p>
<p>(B.Sc. Honours):</p> <p>Zoology</p> <p>(these requirements have been amended for 2011-12 - students entering the programme before this time should consult the entry above or previous Catalogues)</p>	<p>Single Honours Zoology Degree:</p> <p>Level 1: At least 40 credits comprising passes in (BL1201 and either BL1001 or BL1002) or (BL1101 and BL1102).</p> <p>Level 2: At least 60 credits including BL2102 and BL2106.</p> <p>Level 3: 120-130 credits which must include BL3000, BL3320 and at least THREE of BL3306 - BL3307, BL3313, BL3315 - BL3316, BL3319, BL3320.</p> <p>Level 4: BL4200 or BL4202 and FIVE other modules, OR BL4201 and FOUR other modules. Other modules to be chosen will be four or five from BL3400, BL4230 - BL4235, BL4247 - BL4251, BL4256 - BL4261, BL4265 - BL4269, BL4272 - BL4275, BL4280 - BL4282, BL4284, BL4285, BL4286, BL4290 and BL4301; but may also include ONE of BL4291 - BL4293, ID4001. One 4000-level BL module not specified here may be taken as an alternative, with the permission of the Degree Controller and Director of Teaching.</p>

Students still completing degree programmes as defined in previous Course Catalogues should discuss their module selections with their Honours Adviser(s).

Modules

Normally the prerequisite for each of the following Honours modules is entry to the Honours Programme(s) for which they are specified, as well as any additional specific prerequisite(s) given.

General degree students wishing to enter 3000-level modules and non-graduating students wishing to enter 3000- or 4000-level modules must consult with the relevant Honours Adviser within the School before making their selection.

InterDisciplinary (ID) Modules

This School contributes to the following InterDisciplinary modules

ID4001 Communication & Teaching in Science (Section 23)

Biology (BL) Modules**BL3000 Field Course**

Credits: 5 Semester: summer vacation

Co-requisites: BL3308 or BL3309

Description: This module involves field-based exercises in a range of aquatic and/or terrestrial habitats. Students will examine and measure biodiversity, ecophysiological adaptation, and community structure, with both plant and animal material. Class exercises are used to develop good sampling techniques and to generate and analyse large data sets. Students also work in small project groups to develop individual skills in experimental design, practical manipulations, time-management and personal initiative, and in verbal/written presentation of project results.

Class Hour: 1-week residential course.

Assessment: Continuous Assessment =100%

BL3301 Protein Structure & Function

Credits: 20 Semester: 1

Prerequisites: Normally BL1201 and BL2101 or BL2104

Description: This module builds on the material covered in BL1201 and BL2104 to provide an understanding of more advanced aspects of protein structure and enzymology. The module begins by considering the protein-folding problem. The energetics of protein folding and the dependence of structure on sequence are examined. Protein folding diseases like spongiform encephalopathies are used as examples to highlight the significance of protein folding. The molecular basis of prion diseases is discussed in detail. The second part of the module focuses on the mechanisms of enzymes. This in turn leads into the phenomena of allosteric regulation, signalling cascades and transporter systems and is followed by a consideration of enzymes as pharmacological targets. The third part of the module introduces the major techniques for protein structure determination that are at the heart of modern biochemistry, molecular biology and drug discovery. Strategies for obtaining three-dimensional images of macromolecules by electron microscopy, X-ray crystallography and nuclear magnetic resonance are discussed. The laboratory course associated with this module introduces the fundamentals of safe laboratory practice. It provides grounding in the basic laboratory techniques, including associated calculations, as well as those associated with the study of proteins and enzymes.

Class Hour: Lectures: 10.00 am Monday, Wednesday and Friday every week. Practicals: To be arranged.

Teaching: 40-50 contact hours, including up to 35 hours lectures and seminars, plus practicals.

Assessment: Continuous Assessment = 34%, 3-hour Examination = 66%

BL3302 Gene Regulation

Credits: 20 Semester: 1

Prerequisites: Normally BL1201 and BL2104

Description: This module builds on material covered in BL1201 Molecular Biology and BL2104 Biochemistry & Molecular Biology. It first considers the structure of genes and the composition of genomes and then examines genetic activity in eukaryotes in relation to nuclear organization, chromatin structure and epigenetic mechanisms. Regulation of expression at the levels of gene transcription, RNA processing, RNA stability and translation are next covered in detail, drawing particular attention to the nature of protein-nucleic acid interactions. Specific control mechanisms in different prokaryotic and eukaryotic systems, induced by environmental, cell cycle, metabolic and developmental signals, are highlighted.

Class Hour: Lectures: 12.00 noon Monday, Wednesday, Friday every week. Practicals: To be arranged.

Teaching: 40-50 contact hours, including up to 35 hours lectures and seminars, plus practicals.

Assessment: Continuous Assessment = 34%, 3-hour Examination = 66%

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BL3303 Membranes & Cell Communication

Credits: 20 Semester: 1

Prerequisites: Normally BL2101

Description: This module deals with the structural and functional organisation of biological membranes. The dynamic molecular components of biological membranes are studied by investigating the mechanisms involved in the control of membrane fluidity, and the biogenesis of new molecular components of the membrane. The central role that biological membranes play in the regulation of the movement of molecules between different extracellular, intracellular and transcellular compartments is also considered. The process of molecular transport is studied at both a theoretical and practical level. The interaction between the structural and functional organisation of the cell membrane is highlighted by studying the specialisation seen in the major transporting epithelial tissues. Topics covered include: (i) structural and kinetic analysis of ligand-receptor interactions; (ii) GTP-binding proteins and the generation of intracellular second messengers: cyclic AMP, cyclic GMP, diacyl glycerol and inositol triphosphate; (iii) the activation of receptor and intracellular protein kinases: serine/threonine and tyrosine kinases; (iv) desensitisation of signal responses and receptor 'cross-talk'; (v) direct and indirect activation of plasma membrane ion channels. The practical component includes experiments to illustrate methods used to elucidate signalling pathways as well as providing training in laboratory and transferable skills.

Class Hour: Lectures: 9.00 am Monday, Wednesday and Friday every week. Practicals: To be arranged.

Teaching: 40-50 contact hours, including up to 35 hours of lectures and seminars, plus practicals.

Assessment: Continuous Assessment = 34%, 3-hour Examination = 66%

BL3306 Environmental Physiology

Credits: 20 Semester: 1

Description: This module deals with how physiological processes allow organisms to cope with variations in particular aspects of their external environments. A central feature of the course will be an exploration of the responses of organisms (animals in particular, with some comparative studies of plants) to variation in temperature, water availability and osmotic stress, nutrient levels, light, and pressure, both at the molecular and whole organism level, and covering a range of animals from marine, freshwater, terrestrial and parasitic habitats. There will also be analyses of seasonally induced physiological responses, including reproduction, food intake and fattening, torpor and hibernation, including analysis of the mechanisms involved in monitoring and responding to changing conditions.

Class Hour: Lectures: 12.00 noon Tuesday and Thursday and 11.00 am Wednesday every week. Practicals: To be arranged.

Teaching: 40-50 contact hours, including up to 35 hours lectures and seminars, plus practicals.

Assessment: Continuous Assessment = 34%, 3-hour Examination = 66%

BL3307 Evolution

Credits: 20 Semester: 1

Description: Topics in this module will include: molecular variation and evolution, including phylogeny reconstruction; the evolution and maintenance of sex; the genetics of continuous traits, and the relative importance of continuous and discontinuous variation in evolution; evolution of population genetic structure; the genetics of speciation, covering the evolution of pre- and post-zygotic isolation, and parapatric, sympatric and island speciation. Practicals will involve computer simulations to investigate a range of evolutionary phenomena, plus use of molecular markers to examine population structure and speciation.

Class Hour: Lectures: 9.00 am Tuesday and Thursday, 11.00 am Friday every week. Practicals: To be arranged.

Teaching: 40-50 contact hours, including up to 35 hours lectures and seminars, plus practicals.

Assessment: Continuous Assessment = 34%, 3-hour Examination = 66%

BL3308 Aquatic Ecology

Credits: 20 Semester: 1

Co-requisite: BL3000

Description: This module introduces the ecology of aquatic systems beginning with a description of the problems of life in a fluid medium. The module then considers the contrasting conditions that are inherent in freshwater, estuarine and marine systems. The influence of global climate variation and the close coupling between land and sea will be emphasised. Case studies will then be used to introduce the ecology of a variety of aquatic systems including tropical, temperate and polar systems.

Class Hour: Lectures: 11.00 am Monday, Tuesday and Thursday every week. Practicals: To be arranged.

Teaching: 40-50 hours, including up to 35 hours lectures and seminars, and practicals.

Assessment: Continuous Assessment = 34%, 3-hour Examination = 66%

BL3309 Ecosystems & Conservation

Credits: 20 Semester: 2

Prerequisites: Normally BL2105 or SD2001

Co-requisite: BL3000

Description: This module will examine how ecosystems function and how they provide services for humans: information which is essential for ecologists, conservationists and land managers. The module will consider examples of natural systems being altered by man to demonstrate how ecosystems function and the consequences of anthropogenic change. Disturbance and regulation in ecosystems, atmospheric and hydrological regulation, (including the green house effect and acidification), soil ecology, conservation and management of natural resources, agricultural and grazed ecosystems (including GMOs), urban ecosystems and aspects of sustainable development will also be discussed.

Class Hour: Lectures: 12.00 noon Monday, Wednesday and Thursday every week. Practicals: To be arranged.

Teaching: 40-50 hours, including up to 35 hours lectures and seminars, and practicals.

Assessment: Continuous Assessment = 34%, 3-hour Examination = 66%

BL3310 Bioenergetics

Credits: 20 Semester: 2

Prerequisite: BL2104

Description: The conversion of one form of energy into another by a biochemical process is at the centre of all life. This module studies the biological systems for conserving energy from food oxidation and light absorption (photosynthesis) and the conversion of the resulting redox energy into chemical energy in the pyrophosphate bonds of ATP. The module also considers electron transfer processes in biology and the energetics of transport processes. Chemiosmotic theory and the principles are considered in detail as are the structure and function of electron and proton transfer systems of energy transducing systems. Practical classes will introduce the student to the methods used in this field of study. The module will comprise twenty lectures, eight hours tutorials/seminars in total, and twelve hours per week in practical classes.

Class Hour: Lectures: 11.00 am Monday, Tuesday and Thursday every week. Practicals: To be arranged.

Teaching: 40-50 contact hours, including up to 35 hours of lectures and seminars, plus practicals.

Assessment: Continuous Assessment = 34%, 3-hour Examination = 66%

BL3311 Infection & Disease

Credits: 20 Semester: 2

Prerequisites: Normally BL2101 and BL2104

Description: This module has lectures in three component areas: parasite infections, viral disease, and pathogenicity of common bacterial infections, and will include consideration of host defences and effective treatment. In all three component areas the emphasis will be on understanding at the molecular level.

Class Hour: Lectures: 9.00 am Tuesday and Thursday and 11.00 am Friday every week. Practicals: To be arranged.

Teaching: 40-50 contact hours, including up to 35 hours of lectures and seminars, plus practicals.

Assessment: Continuous Assessment = 34%, 3-hour Examination = 66%

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BL3312 Pharmacology

Credits: 20 Semester: 2

Prerequisites: BL2101

Description: This module assumes that students are familiar with the material covered in BL2002 and BL2006. The basic principles of pharmacology will be covered, including evidence to support the modern concept that drugs act via specific receptors present on target tissues and an explanation of our present understanding of laws governing drug-receptor interactions. The concept of agonists, competitive and non-competitive antagonists and the interactions between such classes of drugs will be discussed. The effects of drugs upon the peripheral and central nervous systems and the cardio-vascular system will be covered. How these drugs can be used to understand the function of these systems and to correct their malfunctioning in various disease states will be explained.

The practical component will cover the principles of drug action and receptor theory and illustrate the use of bioassays in pharmacological investigations. The practicals aim to help students build a working knowledge of drug names and actions as well as pharmacological concepts.

Class Hour: Lectures: 12.00 noon Monday, Wednesday and Friday every week. Practical: To be arranged.

Teaching: 40-50 contact hours, including up to 35 hours of lectures and seminars, plus practicals.

Assessment: Continuous Assessment = 34%, 3-hour Examination = 66%

BL3313 Neuroscience

Credits: 20 Semester: 2

Prerequisites: BL2101

Description: This module covers biochemical, cellular and behavioural aspects of the nervous system. It starts with the basic biochemistry of neural membrane proteins such as receptors and channels, and considers the cellular mechanisms of action potential generation and propagation, and synaptic transmission. The physiology of sensory perception is illustrated by examining the visual system, while motor control is considered in terms of vertebrate locomotion. Selected aspects of learning and memory processes are examined from simple invertebrate systems through to the higher primates. Students are given extensive hands-on experience of computer simulation as a learning tool in this course. The associated practical work illustrates the lecture course through experiments on the nerve impulse, sensory processes, and the biochemistry of synaptic transmission.

Class Hour: Lectures: 9.00 am Monday, Wednesday and Friday every week. Practical: To be arranged.

Teaching: 40-50 contact hours, including up to 35 hours of lectures and seminars, plus practicals.

Assessment: Continuous Assessment = 34%, 3-hour Examination = 66%

BL3315 Developmental Biology

Credits: 20 Semester: 2

Description: This module considers the enigma of development, how complexity arises from apparent simplicity when an adult develops from an egg. It examines development from fertilisation to maturity in a range of organisms, but concentrates on higher vertebrates including man, and the fruitfly *Drosophila*. Early-acting mechanisms for generating differences between initially identical cell populations to produce patterning and structure in embryos will be considered. The development of the nervous system will be examined in depth. *Drosophila* embryonic development and the hormonal control of metamorphosis in flies and amphibians will also be studied.

Class Hour: Lectures: 10.00 am Monday, Wednesday and Friday every week. Practical: To be arranged.

Teaching: 40-50 contact hours, including up to 35 hours of lectures and seminars, plus practicals.

Assessment: Continuous Assessment = 34%, 3-hour Examination = 66%

BL3316 Animal Plant Interactions

Credits: 20 Semester: 2

Description: This module concerns the coevolution of plants and animals, including the ecological, behavioural and physiological aspects of their interactions. Pollination biology and the constraints on participating plants and animals are dealt with in depth, including applied aspects of crop pollination, and this is followed by a review of seed dispersal. Then patterns of herbivory by insects, vertebrates and other animals are considered, illustrating the interactions of plant physical and chemical defences and herbivores' reciprocal adaptations from feeding specializations and host plant selection through to detoxification systems and life history adaptations. Interactions with third parties are also explained, especially plant-fungus-insect systems. There is an introduction to other tritrophic interactions (whereby plants can recruit herbivores' enemies as part of their defences, or recruit ants as biotic plant guards), to insects as plant pests, and to integrated and sustainable approaches to control measures and plant protection.

Class Hour: Lectures: 9.00 am Monday, Wednesday and Friday every week. Practicals: To be arranged.

Teaching: 40-50 contact hours, including up to 35 hours of lectures and seminars, plus practicals.

Assessment: Continuous Assessment = 34%, 3-hour Examination = 66%

BL3318 Biology of Marine Organisms

Credits: 20 Semester: 2

Prerequisites: Normally BL2102 and BL2105

Description: This module will include lectures on the range of microbial and metazoan organisms and ecological systems in the marine environment. The coverage will range from bacteria, to algae, invertebrates and vertebrates (fish, birds, reptiles and mammals). The biology of marine organisms is considered in the context of both adaptations at the level of the individual and its expression in terms of large-scale latitudinal and depth-related variations in productivity and food web structure. Examples from the poles to the tropics and from shallow water to the deep ocean will be included. Practicals will be field- and laboratory-based and will provide an experimental introduction to both ecological and physiological problems in marine biology.

Class Hour: Lectures: 12.00 noon Tuesday, 11.00 am Wednesday and Friday every week. Practicals: To be arranged.

Teaching: 40-50 contact hours, including up to 35 hours of lectures and seminars, plus practicals.

Assessment: Continuous Assessment = 34%, 3-hour Examination = 66%

BL3319 Animal Behaviour - a Quantitative Approach

Credits: 20 Semester: 2

Description: This module is designed to provide a broad and multifaceted perspective on animal behaviour, emphasising contemporary theoretical, mathematical and statistical approaches to the discipline. Nobel-Prize-winning ethologist, Niko Tinbergen, pointed out that to understand behaviour fully researchers had to answer four types of questions, about its causation, function, development and evolution. All four areas are covered in the course, which includes lectures on the genetic, neural, physiological and experiential (i.e. learning) influences on behaviour; behavioural development; foraging; sexual behaviour, sexual selection and mate choice; communication, cooperation and culture. The course contains extensive material of a formal theoretical nature, and emphasizes quantitative skills throughout. Students will be introduced to new mathematical and statistical approaches within the field.

Class Hour: Lectures: 11.00 am Monday, Tuesday and Thursday every week. Practicals: To be arranged.

Teaching: 40-50 contact hours, including up to 35 hours of lectures and seminars, plus practicals.

Assessment: Continuous Assessment = 34%, 3-hour Examination = 66%

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BL3320 Practical Statistics for Biologists

Credits: 5 Semester: 1

Co-requisites: Any 3000-level BL module

Description: Few biologists are statisticians but all biologists use statistics. This series of workshops is designed to build confidence in organising and analyzing data to address biological questions efficiently. The module will help you learn how to identify statistical approaches and how to manage and analyse data in code driven statistical programming packages. Two introductory workshops will cover basic concepts and practical training that will be used in a choice of specific workshops that cover applications across the range of Biology.

Class Hour: To be arranged.

Teaching: 2 x 2-hour practicals for each of 4 weeks.

Assessment: Continuous Assessment = 100%

BL3400 Tropical Research & Field Study

Credits: 20 Semester: 1

Description: The module allows the students to study at terrestrial and marine environments for a minimum of four weeks during the summer. Students will gain experience in researching a variety of habitats and investigate the species in locations such as Indonesia, Honduras, South Africa and Mozambique. Students will be introduced to tropical ecology, sustainable development and conservation, fieldwork and novel research methods under the supervision of experts in those research areas. Students will be expected to maintain a journal of their field studies, in addition to being assessed on the application of field techniques and knowledge. The module will culminate in the production of a detailed research proposal.

Class Hour: Lectures, Practical and occasional seminars.

Teaching: 4 weeks in field locations.

Assessment: Continuous Assessment = 100%

BL4200 Literature-based Research Project

Credits: 45 Semester: Whole Year

Description: This project will involve an extensive literature review to investigate a defined hypothesis or problem within the field of biology, appropriate to the degree programme being studied by each student. The project will involve diligence, initiative and independence in pursuing the literature, and the production of a high-quality dissertation that demonstrates a deep understanding of the chosen area of research. Students will be allocated to a member of staff who will guide and advise them in research activities throughout the academic year. The project will be written up in the form of a research dissertation, and presented in the form of an academic poster and an oral presentation.

Assessment: Continuous Assessment = 100%

BL4201 Experimental Research Project

Credits: 60 Semester: Whole Year

Description: This project will involve extensive laboratory or field research to investigate a defined problem within biology, appropriate to the degree programme being studied by each student. The project will involve diligence, initiative and independence in pursuing the literature, good experimental design, good experimental and/or analytical technique either in the field or the laboratory, and excellent record keeping. The project will culminate in the production of a high-quality report that demonstrates a deep understanding of the chosen area of research. Students will be allocated to a member of staff within the School of Biology who will guide and advise them in research activities throughout the academic year.

Assessment: Continuous Assessment = 100%

BL4202 Research Project in Museum Studies

Credits: 45 Semester: 2
Pre-requisite BL4291

Description: The museum-based research projects entail the independent research of a topic appropriate for display in a Museum of Natural History, of interest to, and understandable by, the general public visiting the Bell-Pettigrew Museum. A 3000-word essay on the topic is prepared that prepares the academic and scientific background to the topic. The topic is then presented to the public through the construction of a museum display in a dedicated flat case at the entrance to the museum. A relevant leaflet and an interactive DVD are also prepared to compliment the display. Finally students give a presentation to a knowledgeable audience on the development of the research project. Students wishing to take this museum-based research project must have passed the module BL4291, Science, Museums and the Public.

Assessment: Continuous Assessment = 100%

BL4210 Practical Skills for Molecular Biology & Biochemistry

Credits: 15 Semester: 1

Description: Practical skills are the core of research in biochemistry and molecular biology. This module is designed to prepare students for laboratory research projects in internationally competitive research. The module is designed to foster skills such as experimental design, core practical skills, data analysis and excellent record keeping. Each practical requires some prior theoretical familiarity. Emphasis is placed upon experimental design - notably anticipation of experimental outcomes and the choice of appropriate experimental controls. This planning phase is followed by execution of the experiment and analyses of the data.

Class Hour: To be arranged.

Teaching: Seminars and practicals.

Assessment: Continuous Assessment = 100%

BL4211 Antimicrobials - Mode of Action & Resistance

Credits: 15 Semester: 1

Prerequisite: BL3311

Description: This module will commence by establishing the fundamental basis of antimicrobial efficacy in terms of selective toxicity, with a brief history of antimicrobials and factors that make the ideal antimicrobial. This will be followed by study of the known inhibitory action of antibacterial and antifungal drugs at the molecular level, and study of the molecular basis of microbial resistance to these drugs. Lastly, potential new sources of antimicrobials will be considered, particularly antimicrobial peptides and 'natural' antimicrobials.

Class Hour: To be arranged.

Teaching: Introductory lecture followed by 2 seminars every week.

Assessment: Continuous Assessment = 50%, 1-hour Examination = 50%

BL4212 How Enzymes Work

Credits: 15 Semester: 1

Prerequisite: BL3301

Description: All cells depend on enzymes to catalyse the reactions that produce the energy required for life and that make and repair DNA, proteins and lipids. Understanding enzymes and their regulation underpins research on, for example, drug development. This module will study how the structures and molecular functions of selected examples enable the biological roles. Topics will include flavoproteins, DNA repair enzymes, nitric oxides synthases and other enzymes depending on the research interests of the academic staff. It will develop deductive skills, literature research, and communication of specific knowledge from reviews and primary research articles, and will encourage integration of previous basic knowledge of bioenergetics, protein structure and function, gene expression and metabolic regulation into the exploration of the cellular roles of enzymes.

Class Hour: To be arranged.

Teaching: 2 seminars.

Assessment: Continuous Assessment = 100%

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BL4213 Molecular Virology

Credits: 15 Semester: 1

Prerequisite: BL3311

Description: Viruses as a group include many important human and veterinary pathogens such as influenza virus, hepatitis C virus, foot and mouth disease virus as well as emerging viruses like Ebola virus, and remain a continuing threat to human and animal welfare. This module will consist of a mixture of lectures, tutorials and personal-based learning on aspects of RNA virus host interactions. The topics covered will include comparison of the molecular mechanisms employed by enveloped and non-enveloped viruses to enter and exit from cells, discussion of how small RNA viruses maximize their coding capacity, comparison of the replication of positive and negative strand RNA viruses, discussion of how selected viruses reprogram the host cell to ensure their own replication, description of how RNA viruses intercede with innate immune responses, and understanding of how selected viruses interact with their vectors. In addition, discussion of virus-related topics that have made headline news in recent years will be addressed, and an understanding of the more commonly used molecular techniques to study viruses will be expected.

Class Hour: To be arranged.

Teaching: Lectures and seminars.

Assessment: Continuous Assessment = 40%, 3-hour Examination = 60%

BL4215 Bacterial Virulence Factors

Credits: 15 Semester: 1

Prerequisite: BL3301

Description: In order to establish an infection in a host, pathogenic bacteria rely on mechanisms to adhere to host tissue, gain entry into cells, escape the host's immune response and spread and survive within or on the host. These processes are mediated by bacterial virulence factors, i.e. proteins and other bacterial products that utilise and subvert diverse host cellular processes for the benefit of the pathogen. In this module students will explore how structural biology has led to significant breakthroughs in understanding the molecular bases of some important bacterial infections.

Class Hour: To be arranged.

Teaching: Lectures and seminars.

Assessment: Continuous Assessment = 60%, 1.5-hour Examination = 40%

BL4216 Structure-based Drug Discovery

Credits: 15 Semester: 1

Description: The process of developing a new drug from conception to the clinic takes on average 15 years and costs over \$800M. There are now many examples of drugs developed based on a knowledge of the three dimensional structure of the target, and all major pharmaceutical companies have structural biology as part of their core drug discovery programmes. Many drugs currently used to combat AIDS were developed from a detailed knowledge of key HIV proteins, as were the two drugs used for influenza. Most major pharmaceutical companies are targeting kinases in the search for new cancer therapies, with international efforts focusing on producing structural details of huge numbers of human kinases.

This module will examine case studies of drugs that have been developed with the aid of structure-based methods.

Class Hour: To be arranged.

Teaching: Seminars, essay, and student presentations in teams representing imaginary drug companies.

Assessment: Continuous Assessment = 100%

BL4219 Biocontrol: Microbes as Agents of Biological Control of Pests

Credits: 15 Semester: 1

Availability: Not available 2011-12

Description: Biocontrol is attracting interest as a possible replacement for chemical control of pests; a natural enemy such as a predator or parasite of the organism to be controlled is searched for from the wild and then developed as a control system. Microbes have wide and varied interactions with most organisms including pests, and provide a pool of candidates for biocontrol measures. The microbial biocontrol agent is grown in large amounts in an industrial laboratory and tested rigorously against the target pest, as well as on a range of other organisms to determine host range and to estimate the potential impact on the environment.

This module will explore the possible use of microbes in the biological control of pests to replace harmful chemicals - the success stories, the failures, the shortcomings. In addition the future of biocontrol will be discussed.

Class Hour: To be arranged.

Teaching: 2 seminars.

Assessment: Continuous Assessment = 100%

BL4220 Geomicrobiology - from Gold Mines to Global Warming, how Microbes Influence our Planet

Credits: 15 Semester: 1

Availability: Not available 2011-12

Description: Geomicrobiology explores the interactions between microbes and materials within inorganic environments and investigates the effects of microbial activity on these substances. Throughout the Earth's history, microbes have successfully colonised numerous and different inorganic environments, and in the process have changed the chemical nature of geological materials therein. The current interest in geomicrobiology has been reawakened by climate change and environmental issues.

The module will commence by investigating very early Earth and its initial colonisers 3.7 BYA - the sulphate-reducing and methane-producing anaerobic bacteria - and later development of the aerobic environment. Then issues concerning today's Earth and the consequences of geomicrobial cycling are investigated, as well tomorrow's Earth and the influence of microbial activity on global climate change. What are the future implications of geomicrobiological activity? Finally, hypotheses regarding the geomicrobiology of a variety of newly explored space environments are considered.

Class Hour: To be arranged.

Teaching: 2 seminars.

Assessment: Continuous Assessment = 100%

BL4221 Conus Venom Peptides: Receptor & Ion Channel Targets, & Drug Design

Credits: 15 Semester: 1

Prerequisites: BL3303, BL3313

Description: Neurotoxins have highly specific actions on molecular targets, and many have been adapted for use as therapeutic, diagnostic and insecticidal agents, and as tools that reveal physiological, cellular and molecular mechanisms underlying brain function.

Amongst the predatory cone snails (*Conus*) each is a specialist in neuropharmacology, using venom to capture prey, to escape from and defend against predators, and possibly to deter competitors. Most conotoxins are small, structurally-constrained, disulphide-rich peptides. The module explores their selective targeting of specific isoforms of receptor or ion channels within a variety of molecular targets, namely, voltage-gated and ligand-gated ion channel subtypes, G protein-linked receptors, and transporter proteins. This module therefore offers a general perspective of *Conus* venoms with special relevance to biochemistry, medicine and neuroscience.

Class Hour: To be arranged.

Teaching: 2 seminars.

Assessment: Continuous Assessment = 15%, 3-hour Examination = 85%

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BL4222 Metabolic & Clinical Biochemistry

Credits: 15 Semester: 1

Prerequisites: BL3310

Description: This module extends the students' knowledge of human metabolism and applies it to pathologies. The syllabus includes: a study of the integration of whole body metabolic processes, discussion of the role of biochemistry in investigating and monitoring human disease, the methods of diagnosing and treating some common diseases. Topics will cover integration of whole body metabolism, starvation processes, diabetes, metabolic variability, inborn errors of metabolism, endocrinology, homeostasis, plasma protein metabolism, muscle and hepatic metabolism, drug disposition and metabolism, and defects in glucose and lipid metabolism.

Class Hour: To be arranged.

Teaching: Lectures and seminars.

Assessment: Continuous Assessment = 60%, 3-hour Examination = 40%

BL4223 Chromosome Replication & Genome Stability

Credits: 15 Semester: 1

Prerequisites: Normally BL3301 and B13302

Description: Highly-efficiently chromosomal DNA replication is essential for all forms of cellular life on Earth and requires the complex interplay of a large range of protein factors in a temporally- and spatially-coordinated manner. In humans, defects in the replication process may lead to genetic disease or cancer. This module will summarise current knowledge of the enzymes and mechanisms of chromosomal DNA replication in bacterial, archaeal and eukaryotic cells with particular emphasis on exploring the diverse range of experimental systems and techniques used in the laboratory to probe the structure, function and regulation of the replication apparatus. Similarities and differences between cellular and viral DNA replication strategies will be explored and diverse aspects of the evolution of the replication machinery highlighted.

Class Hour: To be arranged.

Teaching: Lectures and seminars.

Assessment: Continuous Assessment = 60%, 3-hour Examination = 40%

BL4224 Molecular Mechanisms of Membrane Trafficking

Credits: 15 Semester: 2

Prerequisites: BL3303

Description: Membrane trafficking mediates the transport of substances between different cellular organelles and the secretion of substances from cells. As such, regulation of membrane trafficking is applicable to all cell types, but especially to specialised secretory cells such as neurons, which secrete neurotransmitters and pancreatic beta-cells which secrete insulin. This module will consider how molecules control the movement of substances through the secretory pathway, but will focus on how cells regulate the release of contents. Within the module you will look at the proteins involved, the different experiments used to study the process and how model organisms are enhancing our understanding.

Class Hour: To be arranged.

Teaching: Lectures, seminars and fieldwork.

Assessment: Continuous Assessment = 50%, 2-hour Examination = 50%

BL4230 Neurodegeneration & Aging

Credits: 15 Semester: 1

Prerequisite: BL3313

Description: In this module, students will develop a detailed understanding of molecular neuroscience. There will be three main sections. Firstly, how neurons stay alive (eg. neurotrophic factor signalling cascades) is examined; then how neurons age (eg White matter thinning, Gliosis (neuroinflammation), and thirdly, how the nervous system responds to neurodegenerative diseases, in particular Alzheimer's disease. Work will focus at the biochemical and molecular level, so that detailed knowledge of signalling pathways including the kinase cascades from the neurotrophic factors and death pathways will be gained.

The module concentrates on three key areas relating to neurodegenerative processes.

- 1) How neurons stay alive, for example the neurotrophic factor signalling cascades
- 2) The aging nervous system: Changes that can 'prime' neurons for degeneration, degenerative disorders - risks, pathology, treatments. Including a practical session looking at aging murine brains (histology) and at aging neurons and glia in vitro
- 3) How the nervous system responds to neurodegenerative diseases, with particular focus on Alzheimer's disease.

Work will be especially at the biochemical and molecular level, so that detailed knowledge of signalling pathways including the kinase cascades from the neurotrophic factors and death pathways will be gained.

Class Hour: To be arranged.

Teaching: 2 seminars.

Assessment: Continuous Assessment = 34%, 2-hour Examination = 66%

BL4231 Neuromodulation

Credits: 15 Semester: 2

Prerequisite: BL3313

Description: Until recently the nervous system was viewed as a black and white world in which neuronal networks carried out tasks using fast chemical synaptic transmission to produce an appropriate network output. However the output of neuronal networks is not fixed but instead is modifiable under different behavioural or developmental circumstances. A major source of flexibility in the output neuronal networks derives from neuromodulation; a process in which the basic operation of the networks remains the same but the strengths of synaptic connections and the integrative electrical properties of neurons in the networks are changed by the actions of a range of neuromodulators. This module explores the diverse range of neuromodulatory mechanisms and outlines their importance in information processing in the nervous system.

Class Hour: To be arranged.

Teaching: 2 seminars.

Assessment: Continuous Assessment = 50%, 1.5-hour Examination = 50%

BL4232 Neural Mechanisms of Predatory & Avoidance Behaviours

Credits: 15 Semester: 1

Prerequisite: BL3313

Description: Predators and their prey are locked in an evolutionary arms race which continuously refines and improves the abilities of predators to locate and capture prey, and of prey to detect and evade predators. This strong selective pressure has produced some spectacular adaptations in both the nervous systems and the overall anatomy of the animals concerned. This, combined with the usually unambiguous motivation of the animals involved in predator-prey interactions (eat or starve, escape or be eaten) has made such adaptations favoured targets for study by neuroscientists, behavioural scientists, and biomechanicists. Students on this module will undertake a series of guided case studies researching the primary literature, and the module will also include some hands-on laboratory work. The aim is both to uncover some general principles of neural and biomechanical organisation, and also to reveal the variety and ingenuity with which evolution has found different solutions to shared problems.

Class Hour: To be arranged.

Teaching: Seminars and occasional practical classes.

Assessment: Continuous Assessment = 50%, 1.5-hour Examination = 50%

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BL4234 Synaptic Transmission

Credits: 15 Semester: 1

Prerequisites: Normally BL3312 and BL3313

Description: Extensive and versatile communication between nerve cells using special junctions called synapses endows the nervous system with many complex functions like learning and memory. This module will cover important recent progress in understanding the morphology and ultrastructure of synapses, neurotransmitter synthesis, release and clearance mechanisms, synaptic plasticity, the role of glial cells and the development of neurotransmission. Some laboratory work will provide students with hands-on experience of advanced research methods.

Class Hour: To be arranged.

Teaching: Lectures, seminars and 2 practical classes.

Assessment: Continuous Assessment = 40%, 2-hour Examination = 60%

BL4235 Motorneurons: From Physiology to Pathology

Credits: 15 Semester: 1

Prerequisites: BL3313

Description: This module aims to provide in depth knowledge of key aspects of neuronal function and potential dysfunction by focussing on one of the most studied and best characterised classes of neurons in the central nervous system, motoneurons. The module will cover topics such as: the history of motoneurons in neuroscience research; the genetics controlling motoneuron development, the intrinsic electrical properties of motoneurons; synaptic inputs received by motoneurons; motoneuron recruitment; and motoneuron disease.

Class Hour: To be arranged.

Teaching: Lectures, seminars and 2 practical classes.

Assessment: Continuous Assessment = 40%, 2-hour Examination = 60%

BL4247 Practical Whole Animal Physiology

Credits: 15 Semester: 2

Availability: Not available 2011-12

Description: This is a practical module providing experience in whole animal physiology, using teleost fish as experimental models. There will be 3 introductory lectures on the theory behind the practical components. Then students will do practical mini-projects in small groups, involving measurements of (a) metabolic rate in swimming fish, (b) the energy content of biological materials and (c) osmoregulation and drinking rates. There will be an emphasis on developing quantitative skills in data collection and analysis, and on good experimental design.

Class Hour: To be arranged.

Teaching: Lectures and practicals.

Assessment: Continuous Assessment = 100%

BL4248 Human Physiology of Diving

Credits: 15 Semester: 1

Description: This module will provide an understanding of diving physics and how pressure changes affect the physiology of the human diver. It will use both tutorials and self-study sessions to cover theoretical topics such as oxygen toxicity, nitrogen narcosis and the symptoms and treatment of decompression illness. Thermal considerations of diving, long-term effects and the physiology of technical mixed gas and rebreather diving will also be investigated.

Students will also explore applied topics such as the management of diving casualties and the treatment of diving-associated illnesses. The final emphasis will be on how our understanding of diving physiology directs current practice in the UK on safe diving practices.

Class Hour: To be arranged.

Teaching: 2-hour seminar.

Assessment: Continuous Assessment = 60%, 2-hour Examination = 40%

BL4249 Scientific Diving

Credits: 15 Semester: 2

Prerequisite: PADI Advanced Open Water Diver or BSAC Sports Diver (or equivalent)

Description: This module will provide both theoretical and practical experience of the techniques used by scientific divers. The module is restricted to students who have an existing diving qualification (PADI Advanced Open Water Diver or BSAC Sports Diver or equivalent). Seminars during the field trip will cover diving safety, dive project planning, management, risk assessment and the theory behind underwater surveying techniques.

Abroad, students will receive training in underwater marine identification, construction and deployment of underwater surveys and sampling techniques, gaining practical experience of recording, analysing and interpreting survey data. Then they conduct a mini-research project using suitable survey techniques and present their findings through a report and a presentation.

Class Hour: Full Time 2-3 weeks in March/April

Teaching: Lectures, seminars and practicals.

Assessment: Continuous Assessment = 100%

BL4250 Stress Physiology of Fish

Credits: 15 Semester: 1

Description: This module will define the concept of stress, discuss how stress can be triggered and how it is determined, and discuss the ways fish respond to stressors at the physiological and molecular level. The endocrine component in primary, secondary and tertiary stress responses will be described. A number of different environmental stressors will be considered specifically for salmonid fish, because in aquaculture stress can exert important effects that influence the individual fish and this has implications for fish welfare, husbandry and also profitability of the industry.

Class Hour: To be arranged.

Teaching: Weekly 2-hour seminars.

Assessment: Continuous assessment, including a 2-hour open book Examination = 100%

BL4251 Tropical Marine Biology

Credits: 15 Semester: 1

Description: The goal of this module is to examine the ecological and biological principles underpinning the major tropical marine ecosystems. The module provides an understanding of the ecological processes that control tropical marine ecosystems, and considers the organisms that are characteristic of each. All the major tropical marine habitats will be considered, but with a focus on coral reef, seagrass and mangrove ecosystems. The module also tackles topical research areas on the subject through student-led seminars, which will vary depending on the latest scientific research and the specific interests of participants.

On completion of the module, students will have an understanding of coral reef, mangrove and seagrass ecology. They will understand the biology and physiology of corals and be able to identify the major phyla associated with tropical marine ecosystems. The module will also provide an understanding of the threats to tropical marine habitats, current research trends on tropical marine systems, and the scientific approaches and techniques used tackle scientific questions relating to tropical marine biology.

Class Hour: To be arranged.

Teaching: Lectures and seminars.

Assessment: Continuous Assessment = 50% (Grant proposal and Presentation), 2-hour Examination = 50%

BL4254 Fisheries Research

Credits: 15 Semester: 2

Prerequisite: BL3309

Description: This module will provide an introduction to the utilization of fish stocks in a sustainable way. It will focus on how the status of these stocks can be assessed, the problems associated with determining catch limits, and how advice from fisheries scientists is communicated to managers. There will be a mixture of dedicated lectures (including talks from outside experts), student-led seminars, tutorials and practical computer sessions.

Class Hour: To be arranged.

Teaching: Lectures, seminars, tutorials and practicals.

Assessment: Continuous Assessment = 100%

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BL4255 Marine Biotechnology

Credits: 15 Semester: 1

Description: This module will examine the diversity of useful natural products from the sea, consider the ways in which genomic and other approaches are being used to bioprospect for new substances (especially from micro-organisms), learn how genomic approaches are overcoming the problem of unculturability of many marine prokaryotes to find such compounds, and explore some of the more unusual applications of materials derived from marine invertebrates. It will also consider how marine biotechnology is contributing to improved disease control in aquaculture, how it can help the 'greening' of more conventional 'dirty' industries and may enable us to meet our future energy needs via renewable biofuels. The societal, ethical and environmental issues associated with the development of environmental biotechnology are also considered.

Class Hour: To be arranged.

Teaching: Lectures and seminars.

Assessment: Continuous Assessment = 100%

BL4256 Marine Acoustics

Credits: 15 Semester: 2

Description: This module will provide seminar- and practical-based work on both active and passive uses of acoustics in the marine environment. It investigates sound propagation in the ocean, use of sound by man as a sampling tool (*active* acoustic sampling of the water column and seabed), and use of sound by marine mammals for communication and prey detection (as monitored by humans using *passive* listening techniques). It will also examine sound-based conflicts between humans and marine organisms. Two practical sessions will be included, one looking at active use of sound by humans gathering data at sea, the other exploring sound transmission at sea.

Class Hour: To be arranged.

Teaching: Seminars and practicals.

Assessment: Continuous Assessment = 50%, 2-hour Examination = 50%

BL4257 Marine Invertebrate Larval Ecology

Credits: 15 Semester: 2

Prerequisite: BL3318

Availability: Not available 2011-12

Description: Most marine invertebrates include a planktonic larval stage within their life cycle. The adaptive and ecological significance of a larval stage to otherwise benthic (bottom-dwelling) species is open to numerous interpretations, but for species that are sessile as adults, dispersal and colonization potential appears to be of major significance. This module will focus both on larval growth and development during the planktonic stage and also settlement and metamorphosis to the benthic juvenile state. Successful establishment of the post-larval stage is crucial to the completion of the life cycle and understanding the control of larval settlement has major socio-economic implications for species viewed as being detrimental (e.g. fouling) or beneficial (e.g. mariculture) components of marine ecosystems.

Class Hour: To be arranged.

Teaching: Weekly 2-hour seminars.

Assessment: Continuous Assessment, including a 2-hour open book Examination = 100%

BL4258 Foraging in Marine Mammals

Credits: 15 Semester: 1

Prerequisite: BL3319

Availability: Not available in 2011-12

Description: This module will provide primarily seminar and practical-based analysis of the life-history requirements of foraging in marine mammals, geographical and physiological constraints on finding food, food and feeding with a focus on types of prey and adaptations by the prey, adaptations for marine mammals feeding in the marine environment, optimal foraging theory, and optimal diving theory. Initial lectures will focus on theoretical issues and description of methods to study foraging. Students will then conduct case-studies of marine-mammal foraging, which will be presented in a seminar format as a group. Some practical work will also be included.

Class Hour: To be arranged.

Teaching: Seminars and occasional lectures and practicals.

Assessment: Continuous Assessment = 60%, 2-hour Examination = 40%

BL4259 Marine Mammals & Man

Credits: 15 Semester: 1 & 2 (taught twice)

Prerequisite: BL3318

Description: Marine mammals interact with human activities in a variety of ways and are frequently the focus of more general concerns about the health and exploitation of marine ecosystems. This module explores the impact of these activities on individuals and populations of seals and cetaceans, and *vice versa*. Most marine mammals species are long-lived and slow reproducing and the impacts of unmanaged human activities can be severe; a number of species or populations are threatened as a result. The module explores how best to provide robust scientific advice to inform conservation and management at local, national and international level.

Class Hour: To be arranged.

Teaching: Seminars and occasional lectures and practicals.

Assessment: Continuous Assessment = 100%

BL4260 Introduction to Biological Oceanography

Credits: 15 Semester: 1

Availability: Not available in 2011-12

Prerequisite: BL3318

Description: This module will provide primarily seminar-based instruction on the fundamentals of Biological Oceanography (BO). A few introductory lectures will focus on basic principles in BO and oceanography, including physical and geochemical principles as they apply to biological oceanography. Students will present seminars on particular focus areas within each lecture topic, based upon reading primary literature. BO is a broad field, so the module will provide an overview of the field with depth in a few chosen areas. At least one practical will be offered on the use of remote-sensing data for ocean observation, and we hope to develop a practical of zooplankton sampling. This module should coordinate especially well with marine acoustics and scientific diving.

Class Hour: To be arranged.

Teaching: Seminars and occasional lectures and practicals.

Assessment: Continuous Assessment = 70%, 2-hour Examination = 30%

BL4261 Studying Marine Mammals in the Wild: A field course in Iceland

Credits: 15 Semester: Before semester 1

Availability: Not available in 2011-12

Prerequisite: BL3319, and BL3318 which is preferred but not essential

Description: This field course will teach the fundamentals of a suite of field methodologies used in the study of free-ranging cetaceans (whales and dolphins). Students will stay at housing in Husavik, in an integrated field course setting. During week one, students will receive background lectures on the diverse assemblage of dolphins and whales off Husavik, learn the theory and practical use of each of the different cetacean research methodologies. The methods will include: photo-identification, tracking cetaceans at sea, ship-based survey techniques, behavioural observational techniques, vertical-array acoustics using time-delay methods, towed-array acoustics using beamforming, bottom-mounted hydrophone recording, and shore tracking using a surveyor's transit (theodolite). Experts will present research seminars focusing on how the methodologies are used in cutting-edge research. Honours students will focus on understanding the methodologies and what types of science questions could be addressed. Honours students will work alongside Master's level students (MRes) to collect data during fieldwork.

Class Hour: 2 weeks, full-time.

Teaching: Lectures, seminars and practicals.

Assessment: Continuous Assessment = 100%

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BL4265 The Dynamics of Ecological Systems

Credits: 15 Semester: 2

Description: This module aims to give a broad overview of the concepts and fundamental achievements of ecological modelling. By the end of the module, students will understand the motivation and structure behind the statement of various models in the literature, have the terminology necessary to converse intelligibly with modellers and biometricians, and know the benefits and limitations of modelling in different areas of ecology. Topics include: basics of modelling methodology, individual-based modelling, population modelling, ecosystem modelling, and spatial modelling. Further grounding in these topics will be provided in computer-based practicals. Although the module is not equation-free, the emphasis is on concepts rather than mathematical technique. Therefore, the material assumes no more than the basic level of numeracy required for entry in a biology programme.

Class Hour: 2 hours, approx every other week, for the full duration of the 2nd semester.

Teaching: Over the semester there will be 8 lectures, 6 seminars, 1 practical, tutorials as required.

Assessment: Continuous Assessment = 100%

BL4266 Conservation Research Methods: Estimating Population Size

Credits: 15 Semester: 1

Prerequisite: BL3309

Description: The conservation of animal and plant populations relies initially on information of population sizes and trends. This information can only be collected by fieldwork. This module teaches the basic field techniques that underpin the monitoring of populations. Each week the theory behind a different technique is introduced, then the technique is practiced in the field, and finally data collected by the technique are analysed and discussed in a workshop at the end of the week, so that a full understanding of a technique and its proper application is gained. The module ends with students carrying out a project applying and integrating the techniques they have learnt.

Class Hour: To be arranged.

Teaching: 5 x 1-week practicals involving a lecture, a field practical and an analysis workshop each week.

Assessment: Continuous Assessment = 100%

BL4268 Conservation & Management of Biodiversity

Credits: 15 Semester: 1

Prerequisite: BL3309

Description: This module will focus on the scientific problems associated with the conservation and sustainable use of animals and plants, and on the way in which scientific advice on these issues is provided. Initial lectures will cover sustainable development and the precautionary principle; the causes of extinction; the economics of conservation; management of exploitation; and estimating species richness. After this student-led seminars will cover a range of more specialist issues of current concern. Practical work on population viability analysis, classifying populations using the IUCN criteria, and species richness estimation may be included.

Class Hour: To be arranged.

Teaching: 2 seminars per week and occasional lectures and practicals.

Assessment: Continuous Assessment = 100%

BL4269 Icelandic Ecology: Conservation & Sustainable Development

Credits: 15 Semester: 1

Availability: Not available in 2011-12

Description: Students will visit three sites in Iceland and be introduced to aspects of terrestrial, freshwater and marine issues that are relevant to the status of Icelandic ecology and conservation. After introduction to the issues during the visit to Iceland and with the help of regular structured tutorials, students will select and specialise in a particular area of research.

On return to St Andrews students will research their topic by the selective collation of general information over a broad background. Material relevant to their area of study, including detailed research of historical and present day status of selected area, analysis of current status and critique of future management issues will be presented to the group. This will result in an interactive seminar and a written report. Students will be supported by an individual tutor and regular class seminars.

Class Hour: To be arranged.

Teaching: 1 week of fieldwork in June, then occasional seminars and tutorials in St Andrews.

Assessment: Continuous Assessment = 100%

BL4270 Plant-environment Interactions

Credits: 15 Semester: 2

Description: This module will provide an analysis of the ways in which plants interact with their physical, chemical and biological environments. This is a wide-ranging course which will bring together current knowledge of the physiological and molecular responses of plants within the wider context of how whole organisms and communities respond to the environment. Topics include: parasitism, plant pathogens and diseases, symbioses, plant stress responses, and human influences such as pollution, bioremediation and genetic modification.

Class Hour: To be arranged.

Teaching: 2 seminars.

Assessment: Continuous Assessment = 100%

BL4272 Molecular Ecology

Credits: 15 Semester: 1

Description: This module will consider modern molecular approaches that are now extensively used in several key areas of ecology: conservation and population genetics, phylogeography, and ecological genetics; aspects of molecular adaptation; and phylogenetic and genealogical inference.

Class Hour: To be arranged.

Teaching: 2 seminars.

Assessment: Continuous Assessment = 100%

BL4273 Bioinformatics for Biologists

Credits: 15 Semester: 1

Prerequisite: Normally BL3320

Description: This module is about using computers to search and study protein and DNA sequences, and related data such as mRNA expression levels. Vast quantities of such data are publicly available, and, if viewed in the right way, can provide strong evidence concerning function, structure, and evolution of DNA, RNA, proteins and genes. Because of this, computational analysis has become a crucial component of modern biology, including biochemistry, molecular biology, ecology, evolutionary biology and biomedical research. With hundreds of genome sequences and vast quantities of expression data available, the approach has greater potential than ever before. This module will give an overview of the data, software and methods of analysis, and in-depth practical training in applying bioinformatics techniques to questions of biology and biomedical research. Case studies where researchers use genomes to ask questions about divergence, adaptation and speciation will be discussed. The emphasis of the module is not mathematical, but rather concerns data, the general features of methods, use of software, applications relevant to biology, and results. The module will involve use of computers and simple computer programming, for which training will be provided as part of the module.

Class Hour: To be arranged.

Teaching: Lectures, practicals and a seminar.

Assessment: Continuous Assessment = 50%, 3-hour Examination = 50%

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BL4274 Evolutionary Developmental Biology

Credits: 15 Semester: 1

Description: Evolution of new morphologies involves changes to the development of organisms. The field of evolutionary developmental biology is thus becoming established as a major and essential component of any comprehensive understanding of evolutionary biology. This module aims to cover some of the main, current themes in evolutionary developmental biology. Since animal life evolved in the sea, much of what we can learn about the major events in animal evolution can be obtained from studying marine invertebrates. Consequently the examples covered in this module will tend to be drawn from these organisms.

Class Hour: To be arranged.

Teaching: 2-hour seminars.

Assessment: Continuous Assessment = 100%

BL4275 Evolution in Action

Credits: 15 Semester: 1

Description: This module will focus on recent developments relating to evolutionary biology, placing particular emphasis on research related to medical or societal application or public policy. Examples of topics to be covered include: emergent diseases, biodiversity policy, conservation management, biological impacts of climate change, and public understanding of science.

Class Hour: To be arranged.

Teaching: 2 seminars.

Assessment: Continuous Assessment = 100%

BL4280 Evolution & Human Behaviour

Credits: 15 Semester: 1

Description: Evolutionary biologists, anthropologists and psychologists have taken evolutionary principles and used them to explain a range of human characteristics, such as homicide, religion and sex differences in behaviour. Other researchers are sceptical of these interpretations, and critical of the methods. Moreover, researchers disagree as to the best ways to use evolution to explore humanity, and a number of schools of thought have emerged. This module will introduce and critically evaluate the main evolutionary approaches currently being used, including socio-biology, evolutionary psychology, behavioural ecology and gene-culture co-evolution.

Class Hour: To be arranged.

Teaching: 2 seminars.

Assessment: Continuous Assessment = 60%, 1.5-hour Examination = 40%

BL4281 Animal Communication & Cognition

Credits: 15 Semester: 1

Description: Learning to produce sounds is a particularly interesting subject as far as humans are concerned because it is such a notable feature of our own species. Why do we show it, and how did it evolve? As there is little evidence of it in any other primates we need to look further afield for clues. It is found in several other mammalian orders and in three orders of birds, and the evidence for it and nature of it will be examined in these examples. We will discuss why selection may have favoured it in each case. We will also consider vocal learning in a broader sense, including its use in animals that do not themselves produce sounds.

Class Hour: To be arranged.

Teaching: 2 seminars.

Assessment: Continuous Assessment (talk = 30% + handout = 20%) = 50%, 2-hour Examination = 50%

BL4282 Biology & Behaviour of Social Insects

Credits: 15 Semester: 2

Description: This module will examine and compare the biology of the four main groups of social insects: termites, ants, wasps and bees. Sociality in other groups (aphids, beetles) will also be considered briefly. Topics will include the evolution of sociality, social organisation and social control systems, reproductive strategies, and diverse communication modes including pheromonal systems, acoustic systems, and 'bee dances'. Aspects of foraging behaviour and learning abilities will also be considered, particularly for ants (leaf cutter ants, army ants, slave-making ants) and for bees both eusocial and semi-social. There will be strong evolutionary, ecological and behavioural themes, and relevance also to conservation issues.

Class Hour: To be arranged.

Teaching: 1 seminar.

Assessment: Continuous Assessment = 100%

BL4284 Breeding Systems & Sexual Conflict

Credits: 15 Semester: 2

Description: Studies of mating systems in animals are primarily concerned with how animal societies are structured in relation to sexual behaviour. In plants, where many organisms do not have separate males and females, the term refers to the degree to which individuals are self-compatible or the amount of out-crossing that occurs. The effects of breeding system on sexual selection and sexual conflict, together with the costs of inbreeding and the evolution of mating systems, are central concerns of this module.

Class Hour: To be arranged.

Teaching: 2 seminars.

Assessment: Continuous Assessment = 25%, 2-hour Examination = 75%

BL4285 Complex Systems in Animal Behaviour

Credits: 15 Semester: 2

Description: Behaving animals form complex systems, and can create complicated and beautiful phenomena, such as flocks of birds, termite nests, and patterns of army ant swarms. This course will look at research that examines animal behaviour from a complex systems perspective, where analyses range from captive housing of entire bird flocks, computer simulation, and use of robots to interact with the animals. Introductory lectures will be followed by seminar-style discussion of the primary literature, computer practicals, and hands-on practicals where students will identify complex systems in animal behaviour around St Andrews.

Class Hour: To be arranged.

Teaching: Lectures, seminars and practicals.

Assessment: Continuous Assessment, including a 2-hour open book Examination = 100%

BL4286 Advanced Topics in Ecology & Evolution

Credits: 15 Semester: 2

Description: In this module, we will consider a number of outstanding questions, from both molecular and whole organism approaches, currently facing ecologists and evolutionary biologists today. These questions include why we get old and why we have sex, through to why the world is (mostly) green and how will life on earth come to an end. These questions will be relevant to both our understanding of the evolution and maintenance of the biosphere as we see it today, and also in terms of understanding humanity's place in that biosphere. We will take Sherratt & Wilkinson's (2009) recent book *Big Questions in Ecology and Evolution* as our starting point, with student-led seminars bringing us classic and contemporary primary literature to address the topics in more detail. The result will be an exciting opportunity to get to grips with a number of big problems in ecology and evolution, from the perspective of the very latest research in those areas.

Class Hour: To be arranged.

Teaching: Lectures and seminars.

Assessment: Continuous Assessment = 50%, 2-hour Examination = 50%

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BL4290 Networks in Biology

Credits: 15 Semester: 2

Availability: Not available in 2011-12

Description: What do spread of a disease, climate change, visual perception, and development of a sea urchin have in common? They are all involved with or impact biological networks. This module will investigate networks that exist in biological systems across various levels of biological organisation, covering molecular, neural, ecological, and social networks.

The techniques and theory of network analyses will be covered, as well as specific features of networks. Introductory lectures will be followed by seminar-style discussion of the primary literature, and computer-based practicals investigating network behaviour. Students will also participate in and analyse results of a social network experiment.

Class Hour: To be arranged.

Teaching: Lectures, seminars and practicals.

Assessment: Continuous Assessment = 100%

BL4291 Science, Museums & the Public

Credits: 15 Semester: 1 & 2 (taught twice)

Description: This module aims to examine how science in general, and natural history in particular, is presented to the public in a variety of locations. The module will commence with an introductory lecture on the history of British museums and collections. Students will then visit various museums and natural history collections in Scotland. At some of these locations Museum staff will talk about their work. After each visit students will illustrate and discuss the displays and compare what they have seen with their local collection, the Bell Pettigrew Museum of Natural History. The second half of the module will focus on producing a display on an aspect of Biology in the two temporary exhibition cases. This can include a powerpoint presentation or film on a DVD player.

Class Hour: To be arranged.

Teaching: Lectures, seminars and practicals.

Assessment: Continuous Assessment = 100%

BL4292 History of Genetics & Evolution

Credits: 15 Semester: 2

Description: Over the past century and a half, biology has been dominated by the emergence and rise to prominence of two related fields - genetics and evolution. This module provides the opportunity to examine the development of these two subjects, via the life and work of key figures in these fields, and also to compare the way that biological science worked in the nineteenth century with the way it operates today. The course will start with two lectures on the history of Biology, and students will then read material on the life and times of four key individuals - Darwin, Mendel, Watson and Crick. In each case, both original documents and biographies will be considered, and the materials will then be discussed and compared in tutorials. Other key figures in the field will also be studied, and aberrations such as Francis Galton and eugenics, and T.D. Lysenko and Soviet genetics will be discussed.

Class Hour: To be arranged.

Teaching: 2 seminars and occasional lectures.

Assessment: Continuous Assessment = 40% (2,500-word Essay = 20%, Individual presentation = 20%), 3-hour Examination = 60% (answer 2 questions from a choice of 8)

BL4301 Polar Ecology - A field course in Antarctica

Credits:	15	Semester:	2
Prerequisite:	BL2105, BL3308, BL3318 or equivalent preferred but not essential; Medical certificate documenting fit for travel to remote Antarctica		
Availability:	To be confirmed		
Description:	This module will provide a theoretical and practical introduction to the ecology and key ecosystem components of Antarctica with emphasis on marine ecology, ecosystem functionality and conservation issues. Students will participate in a two-week vessel-based expedition to Antarctica during the austral summer (northern winter). This field trip involves traveling to southern Argentina, conducting at-sea surveys during transit to/from the Antarctic Peninsula, participating in shore-based activities (e.g. observations at penguin colonies, visit to active research station), and exploring Antarctic coastal waters from small boats and the ice-strengthened vessel. Through a series of lectures, student-lead seminars, workshops, on-board practicals and field excursions, students will gain appreciation of and insights into the diversity, complexity, scientific and management challenges of the Antarctic ecoregion.		
Class Hour:	To be arranged.		
Teaching:	Lectures, seminars and practicals over a 2-week period.		
Assessment:	Continuous Assessment = 100%		

ID4001 Communication & Teaching in Science

Credits:	15	Semester:	1
Availability:	Available only to final year students who have been accepted following application and interview in the preceding semester.		
Description:	This module is based on the Undergraduate Ambassador Scheme launched in 2002. It provides final year students within the Faculty of Science with the opportunity to gain first hand experience of science education through a mentoring scheme with science teachers in local schools. Students will act initially as observers in the classroom and later as classroom assistants. With permission of the teacher-in-charge, students may also be given the opportunity to lead at least one lesson, or activity within a lesson, during their placement. This module will enable students to gain substantial experience of working in a challenging and unpredictable working environment, and of communicating scientific ideas at various different levels; and to gain a broad understanding of many of the key aspects of teaching science in schools. While of particular value to students aiming for a career in education, these core skills are equally important for any career that requires good communication. Entry to this module is by selection following application and interview during the preceding semester.		
Class Hour:	Flexible		
Teaching:	Occasional tutorials and a half-day training session.		
Assessment:	Continuous Assessment = 100%		

